Shaw®
a world of Solutions™

March 9, 2010

SHAW-MC-CK11-0462
Project No. 800486

Mr. Lee Coker
U.S. Army Corps of Engineers, Mobile District
Attn: EN-GE/Lee Coker
109 St. Joseph Street
Mobile, Alabama 36602

Contract: **DACA21-96-D-0018, Task Order CK11**
Fort McClellan, Alabama

Subject: **Final Responses to ADEM Comments on the Draft RI Report for the Baby Bains Gap Road Ranges**

Dear Mr. Coker:

The subject document is enclosed in both hardcopy and electronic (PDF) format for your records. During a comment resolution meeting held at Fort McClellan on October 11-12, 2007, the Alabama Department of Environmental Management (ADEM) was informed that the Baby Bains Gap Road Ranges with the exception of Range 20 were included in the Environmental Services Cooperative Agreement between the Army and the local reuse authority and that the draft remedial investigation (RI) report would serve as the Army's final deliverable for this site. The Army agreed to revise some of the draft responses for clarity and identify comments that remain unresolved. The Army will address the Range 20 study area separately.

At your request, I have distributed copies of this document according to the attached distribution list. If you have questions or need further information please contact me as indicated below.

Sincerely,

J. Troy Winton

J. Troy Winton
Project Manager

Please Reply To: J. Troy Winton
Phone: 865.670.2698
E-Mail Address: james.winton@shawgrp.com

Enclosure

Distribution: Lisa Holstein, Army TF (4 hardcopies; 1 CD)
Brandi Little, ADEM (2 hardcopies; 1 CD)
Bart Reedy, EPA Region 4 (1 hardcopy; 1 CD)
Peter Tuttle, USFWS (1 hardcopy; 1 CD)
Steve Miller, USFWS (1 hardcopy; 1 CD)
Pete Jerome, USFWS (1 hardcopy; 1 CD)
Robin Scott, MDA (1 hardcopy; 1 CD)
Michelle Beekman, Matrix Environmental (1 hardcopy; 1 CD)

Response to Alabama Department of Environmental Management (ADEM) Comments on the Draft Remedial Investigation Report, Baby Bains Gap Road Ranges, Range 18, Parcel 74Q; Range 20, Parcel 76Q-X; Range 23, Parcel 79Q; Range 26, Parcel 84Q-X; Range 25, Parcels 83Q and 118Q-X; Range 25 East, Parcel 223Q; Range 28, Parcel 86Q; and Area of Further Investigation for Ranges South of Range 25, Parcels 224Q and 226Q Fort McClellan, Alabama (dated August 2004)

Comments from Stephen A. Cobb, Chief – ADEM Governmental Hazardous Waste Branch, Land Division, dated April 9, 2007.

ADEM evaluations of Army responses provided in a letter dated November 5, 2007.

General Response to All Comments:

During a comment resolution meeting held on October 11-12, 2007, at Fort McClellan, ADEM was informed that the Baby Bains Gap Road (BBGR) Ranges with the exception of Range 20 were included in the Environmental Services Cooperative Agreement between the Army and the local reuse authority and that the draft RI report would serve as the Army's final deliverable for the effort. The Army agreed to revise some of the draft responses for clarity and identify comments that remain unresolved. The Army will address the Range 20 study area separately.

GENERAL COMMENTS

Comment 1: **The remedial investigation (RI) report does not adequately describe the investigation conducted or the sampling and analysis strategies used to ensure adequate characterization for each site. Please provide additional information to support the rationale used to determine sample locations, particularly for groundwater. Also, please provide support material used to determine the analytical suite for samples.**

Response 1: The number and types of samples, their locations, analytical program, and sampling rationale were all discussed extensively by the BCT during site visits and the RI scoping process during the BCT meetings. This information was also presented in the various site-specific work plans. Additional information will be added to Chapters 1.0 and 2.0 for clarification.

ADEM Evaluation of Response
Please clarify the rationale for sample locations.

Final Response: This comment is unresolved.

Comment 2: **Please expand the characterization of the extent of metals contamination prior to the preparation of the Feasibility Study. The document maps do not provide a clear presentation of the conceptual distribution of range shot. Please also include in the document a description of the methods in which the bullets' flights were obstructed either by the use of soil backstops or other similar materials, or whether the shot was allowed to**

enter the woods unimpeded in which case the bullets could have potentially traveled miles from the targets.

Response 2: Text will be added to Section 1.2.2 to more fully describe the range impact areas. It should be noted that the contour lines on Figures 1-3, 1-9, 1-12, 1-16, 1-18, 1-22 and 1-24 show the presence of natural hillside slopes that were used by the Army as range "backstops." In areas where no hillsides exist, the Army did not construct any artificial berms. In addition to the other figures cited in this response, 339 surface and depositional soil samples and 144 subsurface soil samples were collected at the BBGR Ranges as shown on Figures 2-1 through 2-9. Additionally, 123 XRF soil samples were analyzed to further delineate the extent of contamination, usually around an existing sample location that contained elevated concentrations of lead and/or copper as shown on Figures 2-1, 2-2 and 2-7. In the Range 25 and Range 28 safety fan areas, 25 soil samples were screened using the XRF to evaluate potential metals contamination (Figure 2-10). The sample locations were determined by observing physical characteristics on aerial photographs and information gathered during site reconnaissance, including a visual survey of surficial bullet fragments. Therefore, the Army feels that the extent of metals contamination has been fully delineated and no further characterization is warranted at the BBGR Ranges.

ADEM Evaluation of Response

The Army's response to Specific Comment 180 references man-made earthen mounds being constructed which conflicts with the statement that the Army did not construct any artificial berms. Please address. Also, please include an outline of the main hillside and berm impact areas on the Figures for the range.

Final Response: This comment is unresolved.

Comment 3: **Please define the extent of contamination on all the Ranges. The depth of contamination appears to be based on a few shallow soil samples and do not show either the full extent of contamination or the maximum degree of contamination. Also, please describe how sampling was keyed to observed or expected conditions at the ranges.**

Response 3: The Army believes that it has collected sufficient data to allow evaluation and selection of a remedy during the feasibility study process consistent with the requirements of the National Contingency Plan (NCP). The following are excerpts from the NCP:

- Section 300.5 (Definition of Remedial Investigation):
  The RI includes sampling and monitoring, as necessary, and includes the gathering of sufficient information to determine the necessity for remedial action and to support the evaluation of remedial alternatives.

- Section 400.430(a)(2):
  The purpose of the remedial investigation/feasibility study (RI/FS) is to assess site conditions and evaluate alternatives to the extent necessary to select a remedy.

- NCP Preamble 55 Federal Register 8708:
  The purpose of the RI, as stated in the proposed NCP, is to collect data necessary to adequately characterize the site for the purpose of remedy selection.

The samples were collected in areas of probable contamination, areas believed to be outside of known contamination, and in areas in between. The sampling program was developed to define the nature and extent of contamination based on the historical use of the ranges and site reconnaissance. The comment that the "depth of contamination is based on a few shallow soil samples…" is simply inaccurate. One hundred and forty-four subsurface soil samples should not be considered "a few." Additionally, based on the site history and expected contaminants, samples were collected in areas expected to exhibit maximum contamination (i.e., biased locations) and at appropriate depths. Metals do not readily migrate downward in soil at FTMC.

It must also be pointed out that the number and types of samples, their locations, analytical program, and sampling rationale were all presented in the various investigation work plans and discussed on several occasions during BCT meetings. The Army questions why ADEM, who was involved in all RI scoping efforts and subsequent data reviews and discussions for the BBGR Ranges, raises issues regarding the adequacy of the investigation nearly 5 years after the fact.

<u>ADEM Evaluation of Response</u>
ADEM notes that a large number of samples were collected at this site. However, the investigations covered multiple ranges and a broad area so the number of samples per range was much smaller. The number of samples continues to decrease as the subsurface is broken down to a variety of depth ranges. Please address. Also, please note that due to the fact that the Army will have to conduct verification sampling and that ADEM still has concerns about the extent of contamination, changes in remedial approach or cost may occur in the future.

Final Response: This comment is unresolved.

Comment 4: **The contamination at each range is site-specific. Please include separate data plots for each range. Please tie the contamination data to distinct areas of the site, such as background, firing points, target areas, and backstops. Please show the data in plan view and cross-section view with annotated points of interest. Since the data is sparse for each range, the extent of contamination should be conceptually portrayed. These types of firing ranges have very predictable contamination impacts and these**

conceptual model aspects should be included in the extent of contamination assessment. Please address.

Response 4: Comment noted. It is unclear how separate data plots for each range will provide any further useful information or understanding of the contamination at the BBGR Ranges. Therefore, the Army feels that it is not worth the time and expense to do so. The contamination maps in Chapter 4.0 generally show pertinent areas of the ranges (e.g., firing lines, target lines and impact areas). However, these maps will be revised as necessary to show additional details wherever possible per the reviewer's request.

Final Response: This comment is unresolved.

Comment 5: **Please clarify if the berms were periodically covered over to avoid ricochets. If the berms were periodically covered then the currently sampled faces may not represent the maximum level of contamination or full extent of contamination. Please address. Also, please clarify whether the berm backsides were evaluated.**

Response 5: Regarding the first part of the comment, it should be noted that Figures 2-1 through 2-9 summarize where soil borings were installed at the BBGR Ranges. These figures can be compared to the site maps and Figures 4-1 through 4-3 to document that the borings were sited in the correct areas to determine depth of penetration in range impact zones and target berms. Hillside impact areas (see response to General Comment 2) were especially targeted for subsurface soil sampling. The Army could not find any specific reference in the document that states, "soil was placed over the berms to cover pre-existing faces." While this practice may have occurred at other FTMC ranges, there is no evidence that this was performed for the BBGR ranges.

To address the second part of the comment, as stated in the response to General Comment 2, the Army did not construct artificial backstops at the BBGR Ranges and chose to use natural hillsides instead. The forward facing natural hillsides (impact areas) were extensively sampled as shown on Figures 2-1 through 2-9. Due to the land contours, no "backside sampling" was warranted. Furthermore, sampling the backside of a berm has no meaningful purpose since the impact area is located in front of the berm, not on the backside; thus the maximum level of contamination would be much less on the backside versus in front of the berm.

<u>ADEM Evaluation of Response</u>

Please provide clarification regarding the absence of periodic covering of the berms in the revised text.

Final Response: This comment is unresolved.

Comment 6: **The document is unclear how x-ray fluorescence (XRF) samples were processed prior to analysis. The document's description of the sampling**

also does not describe the XRF meters used and their capabilities and limitations. Typically, XRF meters also analyze large numbers of other metals at the same time as lead. Please include data for the other metals, if any, and how this data compares to the lab analyses. The report is also unclear as to why so few samples were collected for XRF analysis in the field, since XRF analysis is generally much faster than laboratory analysis and the current soil sampling does not show the depth of contamination above criteria, where as the bottom sample is often as contaminated or more contaminated as the surface soil. Please address.

Response 6: As stated in Section 2.2.8 of the RI report, the XRF soil screening and analysis was either performed at the sample location in the field or in an onsite laboratory. The surface soil samples for the XRF survey were collected and analyzed following methodology specified in the SAP and site-specific work plan. The XRF screening in the BBGR Range safety fans was conducted per the site-specific work plan.

As shown on Figures 2-1, 2-2 and 2-7, 123 locations were selected to further delineate the extent of contamination, usually around an existing sample location that contained elevated concentrations of lead and/or copper. Additionally, in the Range 25 safety fan as shown on Figure 2-10, 25 soil samples were screened using XRF to evaluate potential metals contamination. Lead was considered to be the primary metal of interest and the most likely metal to be present in any significant concentration in these areas where "incidental" contamination was possible. Though the XRF did measure and report other metals and the analyst reviewed these metals for anomalous concentrations, only lead was documented as per the site-specific work plan. Of the 123 XRF screening samples 14 percent (17 samples), were selected for quality control (QC) confirmation analysis at a fixed-base laboratory using EPA Method 6010B for lead.

The XRF screening was performed in the BBGR range fans for a specific purpose (i.e., defining the presence or absence of lead in the fans). XRF was not used during the collection of field samples for laboratory analysis.

<u>ADEM Evaluation of Response</u>

The Army's response does not adequately address of the issues listed in ADEM's review comments. The text in Section 2.2.8 mentions a separate procedure for field screening than lab sampled results. Lab sampled results were air dried and crushed and passed through a No. 10 sieve whereas there is no reference to this for non-lab samples. Please clarify whether the other samples were also processed in this manner. If they were not, then there is a difference in comparing general x-ray (XRF) results to the few selected for lab analysis due to the differences in processing of samples. Neither method meets the requirements of Environmental Protection Agency (EPA) Method 6200 which requires drying by oven rather than air drying. It also requires grinding the sample until 90% of the sample passes a 60 mesh sieve which was not described in the author's method. Please address the issue regarding quantifying the limitations of the XRF methods (e.g., interferences). Please present the metals results for the non-lead constituents as these are readily available and other metals are commonly associated with firing

ranges. Also, please provide a comparison between field XRF analysis readings and laboratory split sampling.

Final Response: This comment is unresolved.

Comment 7: **The discussion of groundwater impacts is limited. It is indicated in the document that the soil and sediment is clearly impacted by lead to at least several feet in some locations. It also states that the depth to groundwater is only two to twenty-five feet. Please address. The document also maintains that lead levels are below background, but it is uncertain as to what constitutes background. Please address. Also, in the area of the site where surface water crosses the site, the aquifer presumably discharges to the surface water unless the surface water is always losing. Please revise the document to provide a description of the surface water-groundwater interactions. Also, please clarify whether the monitoring wells are located upgradient of the impact area and whether groundwater sampling was conducted in areas of maximum soil contamination which are nearest to groundwater.**

Response 7: The geochemical evaluation indicated that the metals in groundwater are naturally occurring. The primary environmental concern at the BBGR Ranges is the prevalence of metals contamination (particularly lead, antimony, and copper) in surface soil. The source of the contamination is bullets and bullet fragments from weapons training. The metals contamination is confined to the portion of the range that served as the impact zone (i.e., the areas adjacent to or downrange of the target line(s) and target mounds where bullets struck the surface). However, the depth of soil contamination typically does not extend more than one foot below ground surface with the very rare exception of isolated impact zone areas (Figure 4-3). As for sediment, the geochemical evaluation concluded that the metals detected in sediment were present at naturally occurring levels except for copper and lead in one sample each from Range 23 (Figure 4-5).

All lead concentrations in groundwater were found to be within the range of background. Background metal concentrations were developed by SAIC and the metals screening values (including lead) are presented in the Final Background Metals Survey Report, Fort McClellan, Alabama (July, 1998).

The BBGR Ranges were oriented with the direction of fire towards the impact zone which was typically the natural hillside. The hillside impact zone collected the bulk of the expended rounds on the surface (Figure 4-1).

Ingram Creek crosses the extreme southern portion of Range 23 and South Branch of Cane Creek flows outside the Range 18 parcel boundary to the east. Therefore, it is unclear which “area of the site where the stream crosses the site” the reviewer is referring to. Ingram Creek and its headwater tributaries drain Ranges 20, 23, 25, 26, and the Ranges South of Range 25. Tributaries of South Branch of Cane Creek drain Range 18. Almost all of the tributaries

to the two creeks are intermittent streams that drain seasonal runoff from winter and spring rain events and generally stay dry during the summer and fall. However, as stated in the RI report there is a very weak upward gradient of groundwater within the residuum.

Groundwater monitoring wells were placed within areas of maximum soil contamination (i.e., monitoring well HR-74Q-MW03 was strategically located within an area of soil contamination with a concentration of 15,000 mg/kg and monitoring wells HR-79Q-MW01, HR-226Q-MW02 and HR-226Q-MW03 were all strategically located within impact areas with lead concentrations exceeding 2,000 mg/kg as presented on Figure 4-1). It should be noted that some monitoring wells (i.e., HR-118Q-MW01 and HR-118Q-MW02) were not installed within extremely contaminated areas (lead results >10,000 mg/kg) due to the presence of unexploded ordnance and steep terrain (hillside) which was unsafe for a drill rig to access.

Comment 8: **Please indicate in the site observations whether the materials of firing were found and quantitative and qualitative analyses of their position were performed. Also, please describe the location of shell casing and their relevance to the conceptual model.**

Response 8: As expected on weapons training ranges, some residual firing materials (e.g., brass casings, expended shotgun shells, unfired blank rounds, and dud cartridges) were found in isolated areas around the firing lines. The firing lines identified on the individual site maps were established in part from historical range records and supported by field observations. The relationship of the firing lines to the target areas was taken into account in developing a conceptual model for each range. The RI sampling and analytical program was tailored to fit this conceptual model with samples collected in the range support zone, firing line areas, and impact zones.

Only isolated occurrences of shell casings were found at BBGR Ranges as expected with typical Army training protocol of "policing" the firing line areas after training to recover the expended shell casings. Available analytical data from samples in the firing line areas of the BBGR Ranges do not indicate the presence of contamination. Therefore, no significant impact to the environment has occurred from shell casings.

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 9: **Please describe the soils that comprise the soil berms, their origin, and the height of the berms. Please clarify how the impact areas were determined.**

Response 9: A description of site soils is included in Section 3.5.1 of the RI report. Available information regarding the physical dimensions and other features of any soil berms at the BBGR Ranges is provided in Chapter 1.0 of the RI report. Most of the ranges used the existing hillsides as impact areas. The probable range impact areas were determined at the work plan stage by reviewing historical information available about the range, its construction, and orientation (direction of fire), and topography. This information was used to develop a range-specific conceptual model. During the investigation, impact areas were assessed by both visually inspecting the area for surficial expended bullets, presence of range signs, berms, targets etc. and by collecting and analyzing surface soil samples for lead and other metals.

ADEM Evaluation of Response

On a map using visual observation of bullet fragments, soil color, historical information, XRF, and lab data, please provide a description of the portion of the hillside that was impacted as indicated in General Comment 4.

Final Response: This comment is unresolved.

Comment 10: **Please expand on the description of the artillery impact area activity.**

Response 10: Information regarding the precise locations of the impact areas is unavailable. The oldest available maps that identified ranges (dated 1917) were general in nature and contained no detail of impact areas. In no case was a range impact area identified. However, the contour lines for each range are present on Figures 1-1, 1-3, 1-4, 1-9, 1-12, 1-16, 1-18, 1-19 and 2-1 through 2-9. These contour lines show the presence of natural hillside slopes that were used by the Army as range "backstops". Additionally, site reconnaissance, review of aerial photographs and visual surveys were conducted during the preparation of the work plan phase to more fully understand the most probable impact areas in relationship to the range safety fan areas.

ADEM Evaluation of Response

Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 11: **The document made significant efforts to justify eliminating metals from evaluation in the risk assessment. ADEM's Alabama Environmental Investigation and Remediation Guidance allows for the elimination of metals that are below two times the arithmetic mean background concentration. Please include all site-related metals above this background concentration in the risk assessment to ensure adequate representation of site cumulative risks.**

Response 11: As noted in Chapter 6.0 of the RI report, the human health risk assessment was conducting following the methodology described in the Installation-Wide Work Plan (IWWP) finalized in 1998. The AEIRG, on the other hand, first

appeared in March 2002, was revised in October 2002, and was last revised in September 2005. The approach to background screening for FTMC described in the IWWP and approved by EPA and ADEM preceded the AEIRG.

In 2002, the Army began including a three-tiered statistical and geochemical evaluation as part of the background screening procedure at FTMC to increase accuracy and reduce the number of false positives that could result in unnecessarily costly remediation in violation of CERCLA guidance not to require cleanup below background levels. Introduction of the three-tiered background screening protocol generated several rounds of comments, responses to comments, and lengthy negotiation that lead to two subsequent revisions of the process. It is noteworthy that the AEIRG including its first revision was available to ADEM while these negotiations were in progress before the later revisions of the three-tiered background screening. However, not once during these negotiations did ADEM state or imply that the three-tier background screening approach was inconsistent with the AEIRG or ADEM guidance. Furthermore, following the AEIRG would reduce the background screen to the two-times-background-mean comparison, negating all of the refinement that has been approved and applied since 2002.

The latest revision of the three-tiered background screening process is detailed in the technical memorandum entitled "Selecting Site-Related Chemicals for Human Health and Ecological Risk Assessments, Revision 3" dated March 14, 2005. In February 2006, the BCT decided to use the geochemical evaluation (Tier 3 of the three-tiered protocol) as merely one line of evidence in selecting site-related constituents for inclusion in the risk assessments rather than using it as the sole deciding factor.

ADEM confirmed the use of the 3-tiered background screening protocol at FTMC during the October 11-12, 2007 comment resolution meeting.

<u>ADEM Evaluation of Response</u>
Please evaluate chemicals with concentrations above Tier 1 levels in the risk assessment.

Final Response: This comment is unresolved.

Comment 12: **The stated objective of the Remedial Investigation was to determine the nature and extent of contamination at the Baby Bains Gap Road (BBGR) Ranges. The provided data is not sufficient for determining the risk to human health and the environment. Please address.**

Response 12: The Army respectfully disagrees and believes that it has collected sufficient data to adequately determine risks to human health and the environment for the purposes of selecting a remedy as part of the feasibility study process per CERCLA and the NCP. See response to General Comment 3.

<u>ADEM Evaluation of Response</u>
Please see evaluation of response to General Comment 3.

Final Response: This comment is unresolved.

Comment 13: **Please delineate the extent of site related contamination in the surface soil at all Ranges. The document illustrates that there were widespread levels of lead above screening level present in surface soils within the Ranges. Please consider and address the potential for the mobilization and deposition of site related contaminants by wind from areas containing sparse or no vegetation. Please include documentation for all methods and decision making utilized during the collection of subsurface soil samples. Also, please delineate the extent of site related contaminant migration to subsurface soils at all Ranges.**

Response 13: Per the various work plans prepared for the BBGR Ranges, determining the nature and extent of contamination including the surface soil was an objective of the RI. A total of 339 surface and depositional soil samples were collected and the lead concentrations were plotted as an isopleth map (Figure 4-1) that showed contamination at the BBGR Ranges is generally present in target areas and in the hillside impact zones. The exceptions were Range 18 and the Ranges South of Range 25, both of which are relatively flat areas and exhibited widespread lead contamination over a large portion of the area of investigation.

Additionally, Chapter 5.0 (Section 5.2.1) indicates that "Erosion of soil by wind is not likely at the majority of the BBGR Ranges due to the presence of grassy areas and wooded cover." Regardless, potential windblown deposition of contaminants was addressed in the sampling program by collecting samples adjacent to the bare areas and the ranges in general. Documentation for all methods used was outlined in the individual investigative work plans, Installation-Wide SAP and subsequently discussed during various BCT meetings. Based on the subsurface soil sampling data, the depth of contamination typically does not extend more than one foot below ground surface. Subsurface soils are those that extend greater than 1-foot below ground surface. The metals contamination is confined to the portion of the range that served as the impact zone (i.e., the areas adjacent to or downrange of the target line(s) or target mounds where bullets struck the surface).

Comment 14: **A significant portion of Range 20, Parcel 76Q-X was removed from the investigation because the area was reportedly excavated and the area currently contains a 10 foot security fence. Please include a description of the soil removed, the depth of soil removal, the post-excavation soil sampling results, the depths of explosion pits and the subsurface soil conditions beneath the pits, the source material for the new fill, and any impacts to underlying groundwater. The resultant analysis on the nature and extent of contamination and associated risks cannot be used for decision making purposes at Range 20, Parcel 76Q-X. Please include data gathering and analysis of the potential impacts to soil, subsurface soil, and any migration to groundwater at this area from site related uses.**

Response 14: The soil removal at Range 20 was conducted by Calhoun County Highway Department personnel on September 2, 1999. A map showing the excavation limits was provided to ADEM in a letter dated October 8, 1999. Approximately 1,100 cubic yards of soil were removed, transported, and stockpiled at seven separate locations for later use. The stockpile locations included six county highway department locations and one location within the Alabama Army National Guard Enclave at Fort McClellan. The Army requested that IT Corporation (now Shaw Environmental, Inc.) collect samples of the stockpiles to ensure that the soil did not contain potential site-related contaminants (i.e., lead and explosive compounds). The sample results showed that the soil was not contaminated. A reference to the Range 20 soil removal and sampling report will be added to the revised RI report.

Fill material was not placed at the site. The depths of explosion pits are not known but are expected to have been fairly shallow based on the training objectives at the site (i.e., simulation of warfare condition during infiltration maneuvers). Based on the results of the soil samples collected, the subsurface soils do not appear to have been impacted. Future investigation of fenced area is not anticipated. Activities will be focused on the machine gun impact area located south of the fence.

As noted previously, the Army will address Range 20 separately. Available information regarding the fenced area, including the soil removal previously conducted, will be included in the Army's report for Range 20.

ADEM Evaluation of Response

Historical information indicates the use of explosives (e. g., dynamite, TNT and C4) at Range 20. Although excavated soils were sampled prior to disposal, characterization of in-situ contamination was not conducted. Please address. Also, please clarify what analyses were conducted on the stockpiled soil designated for disposal and whether this data meets data quality objectives (DQO) for risk assessment. Monitoring well HR-83Q-MW04 which is located at a significant distance downgradient of Range 20 had detections of 2,4- and 2,6-dinitrotoluene and no apparent source exists between this well and Range 20. Please address.

Final Response: This comment is unresolved.

Comment 15: **The comparison of an average concentration over the EU to the cleanup level may be appropriate where a site is adequately characterized and receptor exposure is known to occur randomly over the EU. Although numerous samples were collected in soil, the various analyses selected limited the analytical data obtained from any given sample, reducing the adequacy of the site characterization. Also, hot spots are not considered, and numerous modifications were made to the cleanup levels to reduce their conservative bias. Please evaluate areas in each range where sample concentrations exceed the applicable cleanup levels for remedial options.**

Response 15: This comment identifies two issues: (1) adequacy of site characterization for risk assessment, and (2) the application of exposure units (EU) in the Streamlined Human Health Risk Assessment (SRA). Several other general and specific comments question the adequacy of site characterization; this issue is addressed fully in response to these other comments. Several comments on Chapter 6 (Specific Comments 151, 155, 162, 163, 166) question the application of EUs; this issue is addressed fully in response to these comments. In response to this general comment, however, suffice it to say:

- The future site-use data currently available do not permit precise identification of EUs.
- How EUs are established (i.e., where they are located, or how large or small they are) has no impact on the cleanup levels that are established for specific chemicals of concern (COC).
- All sample locations with COC concentrations that exceed cleanup levels are identified; therefore EUs need not be established to ensure that the higher concentrations are not overlooked.

<u>ADEM Evaluation of Response</u>

The exposure units (EUs) have an impact on the selection of chemicals of concerns (COCs). Large EUs will likely lower the source-term concentration (STC) used to compare chemicals of potential concern (COPCs) to site-specific screening levels (SSSLs). Those COPCs above SSSLs were identified as COCs. Because unrealistic EUs were established, the STCs are diluted by data not representative of source areas, resulting in not identifying all COCs that were then compared to cleanup levels. Please address.

Final Response: This comment is unresolved.

Comment 16: **Please justify the lack of additional semi-volatile organic compounds (SVOC) sampling at the Ranges when several of the limited SVOC soil samples contained compounds above screening levels. Also, please include an interpretation of the extent of SVOC contamination at the Ranges.**

Response 16: Disagree. The soil sampling program was not limited with respect to SVOCs. Fifty-four surface and depositional soil samples and 26 subsurface soil samples were analyzed for SVOCs using EPA Method 8270C. Six SVOCs (primarily PAHs) were detected sporadically in surface soil at levels exceeding ESVs. However, they showed no discernable pattern of contamination. Furthermore, all detected levels of SVOCs in subsurface soil were below SSSLs.

As noted in the RI report, Range 26 sample location HR-84Q-GP06 contained several PAHs that exceeded SSSLs/ESVs and PAH background values. However, Range 26 (Parcel 84Q) was constructed with creosote-treated wood

railroad cross ties used to form firing points and they could be a possible source of the limited PAH contamination at this range, but as previously noted there is no discernable pattern of contamination.

Comment 17: **Surface water and sediment sampling was not designed to clearly determine background conditions and the extent of downstream contaminant migration. Please include a more detailed presentation of site specific surface water hydrology (e.g. flow rates, peak flows, flooding, overland flow, channel scouring, peak storm erosion and downstream deposition, and seasonal sedimentation downstream in the affected drainages) in the document.**

Response 17: Agree that the extent of surface water and sediment contamination in Cane Creek downstream of Range 25 was not delineated to background levels. Evaluation of surface water, sediment and depositional soil data from other FTMC sites shows that portions of Cane Creek downstream of the BBGR Ranges (and the Bains Gap Road Ranges located further upstream) have been impacted by lead and other munitions-related metals. However, the Army believes that sufficient data were collected during the RI to allow evaluation and selection of a remedy during the feasibility study process. The remedy will address Cane Creek to the extent necessary to meet CERCLA requirements.

Disagree that the extent of surface water and sediment contamination in South Branch of Cane Creek (downstream of Range 18) and Ingram Creek was not delineated to background levels. As shown on Figures 4-5 and 7-2 of the RI report, lead and/or copper results in the downstream areas of these creeks were below background.

ADEM Evaluation of Response

Please address the specific issues listed in the ADEM review comment.

Final Response: This comment is unresolved.

Comment 18: **The groundwater investigation presented in the report did not define the horizontal and vertical extent of contamination. Site-specific hydrogeologic conditions should be determined to better understand the nature and extent of contamination in groundwater. The groundwater investigation completed to date should be considered a preliminary investigation as opposed to a comprehensive investigation. A comprehensive investigation of groundwater should include potential preferential pathways (layers of course grained material) identified during this initial groundwater sampling phase. Please address.**

Response 18: Disagree. The Army does not consider the groundwater investigation to have been "preliminary" in nature and believes that sufficient data were collected to determine that groundwater has not been impacted by historical site activities at the BBGR Ranges. The RI demonstrated that metals contamination,

although present in soil at the BBGR Ranges, is not present in site groundwater.

Nitroaromatic explosives and pesticides were detected in site groundwater at very low levels (mostly estimated or "J" flagged). The Army believes that further investigation of these compounds is unnecessary based on the following lines of evidence: (1) the particular explosive compounds detected are not related to historical site activities (i.e. small arms fire and mortar firing point); (2) with the exception of 2,4-DNT and 2,6-DNT in surface soil, the explosives detected in groundwater were not detected in site soils (3) the SSSLs used for risk screening are very conservative values; (4) almost all of the BBGR Ranges are included in the planned U.S. Fish and Wildlife Service (USFWS) refuge, a passive recreation reuse area. At Range 18, the northern portion of the area of investigation (firing line and target line areas) is planned for industrial reuse and the southern part (including the hillside impact zone) is planned for USFWS refuge. (5) the source of contamination is bullets and bullet fragments from weapons training and mostly confined to the portion of the range that served as the impact zone (i.e., the areas adjacent to or downrange of the target line(s) or target mounds where bullets struck the surface); (6) The explosives and pesticides detected in groundwater were isolated low-level detections in groundwater and showed no discernable pattern of contamination.

ADEM Evaluation of Response

Nitroaromatic explosive compounds are not naturally occurring. Therefore, their presence is a result of impact from site activities. The horizontal and vertical extent of contamination has not been determined. Additional characterization is warranted to address this data gap.

Final Response: This comment is unresolved.

SPECIFIC COMMENTS

Comment 1: **Pages ES-1 and ES-2. Please discuss any site-specific correlations developed between the XRF soil screening data and the fixed-based laboratory analysis to provide confidence that the XRF date can be relied upon solely to characterize the safety fan area.**

Response 1: This information is provided in Section 4.2 of the report. This level of information is inappropriate for inclusion in the Executive Summary.

ADEM Evaluation of Response

Please state in the Executive Summary that the XRF data was correlated with fixed-base laboratory analyses and provide the outcome. Also, please include information regarding the extent to which the XRF data was used for site characterization, a brief accounting such as the number of soil samples screened and the approximate aerial extent of the locations characterized.

Final Response: This comment is unresolved.

Comment 2: **<u>Page ES-2.</u> Page ES-1 notes that several of the ranges were constructed on land that was previously used for other types of training. Please clarify the potential sources of contamination and the activities that were previously conducted at these ranges which could possibly have contributed to the contamination.**

Response 2: The EBS suggests that other ordnance-related training may have occurred at or near two of the BBGR Ranges. At Range 23, artillery shell fragments were found by FTMC personnel "a short distance west of the range." At Range 26, FTMC personnel noted that the presence of hard targets at this range indicated that large caliber weapons training had occurred at sometime in the past. Potential contaminants from these other ordnance-related activities (i.e., metals, explosives) are expected to be the same as those from later weapons training activities at the BBGR Ranges. The sentence in question will be revised to "…previously used for other types of *ordnance* training."

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text. Also, please note in the document that a visual survey for bullet/fragments has not been conducted at the Iron Mountain Road (IMR) Ranges.

Final Response: This comment is unresolved.

Comment 3: **<u>Page ES-3.</u> The presence of bullets and associated fragments represents an ongoing source of contamination. Please clarify which measures will be implemented to address this source.**

Response 3: This will be addressed in the feasibility study.

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 4: **<u>Page ES-3.</u> Please clarify if the extent of bullets and bullet fragments has been delineated and also discuss any uncertainty in this delineation.**

Response 4: Agree. A statement will be added that clarifies the extent of bullets and fragments. However, it should be noted that a visual survey for bullets/fragments was not performed at the BBGR Ranges.

<u>ADEM Evaluation of Response</u>
Response is adequate provided the manner in which the bullet and fragment extent is clarified.

Final Response: This comment is unresolved.

Comment 5: **<u>Page 1-2, Section 1.0.</u> Please clarify how many safety fans were investigated.**

Response 5: Only the Range 25 safety fan was investigated. However, most of the Range 28 safety fan lies within the Range 25 safety fan as shown on Figure 2-10.

Comment 6: **<u>Page 1-5, Section 1.2.2.1.</u> Please clarify whether the environmental samples were analyzed for the tracer compounds used for the M-16 rifle night fire training.**

Response 6: The EBS indicates that white phosphorus (WP) was used as the tracer material for M-16 training at some of the BBGR Ranges. The RI samples were not analyzed for WP. While WP is hazardous, it is logical to assume that the quantities of it used would be very low. M-16 rounds are very small caliber (5.56-mm), lightweight, and tracer rounds would have been fired only approximately every fifth round; therefore, only miniscule amounts of WP would have been used at the range. Secondly, one should consider the highly reactive, pyrophoric chemical nature of WP – it oxidizes (burns) white hot immediately upon exposure to oxygen in air. It is the bright light from oxidation gives the round it's ability to be used as a "tracer." Considering the very small amount of WP present in M-16 tracer rounds and its highly volatile nature, any WP present at the BBGR Ranges is expected to be insignificant.

It should be noted that each phase of the investigation work conducted at the BBGR Ranges was discussed by the BCT and subsequently performed as stated in the site-specific work plan for that phase. Analysis for WP at these ranges (or any other historical ranges at FTMC) was neither discussed by the BCT (including ADEM) nor included in the site-specific work plans.

Nonetheless, during the October 11-12 comment resolution meeting, the Army agreed to collect a sample from the Range 20 impact area for WP analysis to determine if WP is a potential contaminant of concern at FTMC. White phosphorus was not detected in the sample.

Comment 7: **<u>Page 1-6, Section 1.2.2.1.</u> Please clarify if the concrete-lined drainage ditch that runs adjacent to the target line and the drainage ditch that runs along the road were sampled for lead. Also, please identify any limitations from the absence of surface water and sediment from the drainage ditches.**

Response 7: HR-74Q-DEP03 was collected in the area of the concrete lined ditch near the target line and four other depositional soil samples (HR-74Q-DEP01 through HR-74Q-DEP05) were collected from natural surface drainage features within the range. Because the depositional soil samples were collected directly in the dry streambeds, the data are sufficient to characterize the study area in the absence of surface water/sediment data. Also, a surface water/sediment sample was collected from Cane Creek, just downslope of the range.

Comment 8: **<u>Page 1-7, Section 1.2.2.2.</u> Please clarify the type of tracer used with the M-60 weapon at Range 20 and whether the chemical constituents of this tracer were investigated in the characterization of contamination in the environmental media.**

Response 8: The EBS indicates that white phosphorus (WP) was used as the tracer material for M-60 training at Range 20. The RI samples were not analyzed for WP. However, based on discussions during the October 11-12 comment resolution meeting with ADEM, the Army agreed to collect a sample from the Range 20 impact area for WP analysis to determine if WP is a potential contaminant of concern at FTMC. White phosphorus was not detected in the sample.

Comment 9: **<u>Page 1-7, Section 1.2.2.2.</u> Please clarify if the activities conducted, the ordnance used, and the locations where activities took place at Old Range 27 (OA-35) and the World War I (WW I) Artillery Impact Area are similar to those documented for Range 20. Please describe any difference that could affect the characterization approach for this area.**

The ASR states that the WWI Artillery Impact Area consisted of a northern section (2,500 acres) and a southern section (4,500 acres) used from approximately 1912 to the beginning of WWII. Old Range 27 was a small-arms range (approximately 10 acres) located within Range 20. As stated in the RI report, this range was abandoned in 1967.

Potential contaminants from these older ordnance-related activities (i.e., metals, explosives) are expected to be the same as those from later weapons training activities at the BBGR Ranges.

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 10: **<u>Page 1-7, Section 1.2.2.2.</u> Please provide a figure that overlaps the areas occupied by Range 20 and 27 and the WW I Artillery Impact Area.**

Response 10: Agree. Figure 1-10 will be revised to show former Range 27 and the WWI Artillery Impact Area.

Final Response: This comment is unresolved.

Comment 11: **<u>Page 1-7, Section 1.2.2.2.</u> Please clarify whether the security fencing will remain in-place in the future. Also, please clarify in the document that any conclusions pertaining to Range 20 do not pertain to the portion of the site within the security fencing.**

Response 11: It is expected that the security fence will be removed. Please see response to General Comment 14.

ADEM Evaluation of Response
The Army's response does not address the applicability of the overall report conclusions to Range 20. The information provided regarding Range 20 does not indicate whether confirmation sampling was conducted after soil removal. Because this area was fenced and no sampling was conducted as part of the RI, please provide justification that the results of the RI and risk assessment are applicable to this area.

Final Response: This comment is unresolved.

Comment 12: **Page 1-7, Section 1.2.2.2. Please correct the typographical error and misspelling of the word "regarded".**

Response 12: Agree. The text will be revised per the comment.

Final Response: This comment is unresolved.

Comment 13: **Page 1-8, Section 1.2.2.3. Please clarify the type of tracer used with the M-16 weapon at Range 23 and whether the chemical constituents of this tracer were investigated in the characterization of contamination in the environmental media.**

Response 13: The EBS indicates that white phosphorus (WP) was used as the tracer material for M-16 training at Range 23. The RI samples were not analyzed for WP. See response to Specific Comment 6.

Comment 14: **Page 1-8, Section 1.2.2.3. Please clarify if the activities conducted, the ordnance used, and the locations where activities took place at Old Range 23, the WW I Artillery Impact Area, and Combat Range #1 are similar to those documented for Range 23. Please describe any difference that could affect the characterization approach for this area.**

Response 14: The ASR states that the WWI Artillery Impact Area consisted of a northern section (2,500 acres) and a southern section (4,500 acres) used from approximately 1912 to the beginning of WWII. Combat Range #1 (120 acres) was built during the Inter-War period. During WWII, the Combat Range #1 area is broken up into other uses including new ranges. Range 23 is a small-arms range (approximately 60 acres) with a portion of the safety fan located within the Combat Range #1 area.

Potential contaminants from these other ordnance-related activities (i.e., metals, explosives) are expected to be the same as those from later weapons training activities at the BBGR Ranges.

ADEM Evaluation of Response
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 15: **<u>Page 1-8, Section 1.2.2.3.</u> Please provide a figure that overlaps the area occupied by Range 23, the WW I Artillery Impact Area, and Combat Range #1.**

Response 15: Comment noted. Figure 1-10 will be revised to show the WWI Artillery Impact Area and Combat Range #1.

Final Response: This comment is unresolved.

Comment 16: **<u>Page 1-10, Section 1.2.2.4.</u> Please clarify if any tracers were used as part of night fire or other training. If tracers were used, please note if the chemical constituents of this tracer were investigated in the characterization of contamination in the environmental media for Range 26.**

Response 16: According to the EBS, Range 26 is not known to have been used for night firing.

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 17: **<u>Page 1-10, Section 1.2.2.4.</u> The document states that "bullet channels and fragments are present all around the vehicles" referring to the parked vehicle area along the hillside, but this area was not sampled as part of the RI. Please explain why this area was not sampled.**

Response 17: The sampling rationale for the various ranges were repeatedly discussed by members of the BCT and later presented in the site-specific work plans. Furthermore, this area is obviously highly contaminated as evidence from the visual survey conducted.

<u>ADEM Evaluation of Response</u>
Please address the existing data gaps. This information is needed to develop a complete understanding of the contamination that will need to be remediated.

Final Response: This comment is unresolved.

Comment 18: **<u>Page 1-11, Section 1.2.2.5.</u> Please clarify if the environmental samples were analyzed for the tracer compounds used with night fire and other training for Range 25.**

Response 18: The EBS indicates that white phosphorus (WP) was used as the tracer material for training at Range 25. The RI samples were not analyzed for WP. See response to Specific Comment 6.

Comment 19: **<u>Page 1-11, Section 1.2.2.5.</u> The report indicates that mortar and artillery rounds were identified and suggests that the mortars were practice rounds. Please include a description of the artillery rounds.**

Response 19: The Army will attempt to find historical information about the artillery rounds and include it in the revised report.

Final Response: This comment is unresolved.

Comment 20: **<u>Page 2-1, Section 2.2.</u> Please clarify why at Range 23 polychlorinated biphenyl (PCBs) were detected at location HR-79Q-SB-10, however, PCBs were not analyzed in the remaining samples. Also, please clarify why nitroaromatics were detected in site groundwater, but are not a target analyte for soil samples.**

Response 20: Based on agreement by the BCT, it has been the general practice during environmental investigations at FTMC historical ranges to analyze 10 percent of the samples for full-suite analyses (e.g., pesticides, herbicides, PCBs). The rationale is that these additional constituents are not expected at weapons firing ranges. Please note that PCB Aroclor 1260 was detected at an estimated ("J"-flagged) concentration (i.e., below the method reporting limit) in only 1 of 79 site samples analyzed for PCBs. The detected level (0.022 mg/kg) only slightly exceeded the ESV of 0.02 mg/kg. The source of this single detection is unknown. However, other compounds (e.g., organochlorine pesticides) can mimic PCBs at the low level detected.

The second part of the comment is confusing. Over 200 soil samples were analyzed for explosives at the BBGR Ranges indicating that explosives were one of the primary target analyte groups in soil and other site media. At Range 23 alone, 35 soil samples were analyzed for explosives.

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 21: **<u>Page 2-1, Section 2.2.</u> Please justify the well screen placement at HR-84Q-MW03.**

Response 21: Residuum monitoring wells were installed in the first water-bearing zone encountered. Deep residuum wells were installed in the second water-bearing zone encountered and bedrock wells were installed in bedrock. The monitoring wells and corresponding screen interval depths were installed as described in the Final Engineering Evaluation/Cost Analysis Site-Specific Field Sampling Plan for the Baby Bains Gap Road Ranges, January 2002. The well screens were installed at depths such that approximately half of the screen was above the surface of the water table and half of the screen was below the surface of the water table.

Additionally, well installation procedures followed the guidelines and Standard Operating Procedures as outlined in the Installation-Wide SAP, Revision 3, February 2002. Furthermore, the proposed monitoring well locations, rationale and projected screen intervals and corresponding depths were repeatedly discussed by members of the BCT prior to the RI field investigation.

ADEM Evaluation of Response

Please provide rationale for screen-depth selection for bedrock wells. Also, please identify fractures, increases in groundwater flow, etc.

Final Response: This comment is unresolved.

Comment 22: **Page 2-1, Section 2.2. At Range 25, there is evidence in the boring logs of groundwater migrating along the residuum/bedrock interface. Groundwater samples from this interface do not appear to be representative of the upper most aquifer, rather water perched on top of the bedrock. Please discuss the groundwater monitoring program including the nature and extent of site related contamination in the upper most aquifer at Range 25, Parcel 83Q and Parcel 118Q-X.**

Response 22: Groundwater at FTMC tends to migrate along the residuum/bedrock interface. The monitoring wells were installed as previously stated in the response to the previous comment. Two explosive compounds 2,4-Dinitrotoluene and 2,6-Dinitrotoluene were detected at concentrations exceeding their respective SSSL in well HR-83Q-MW04 as shown on Figure 4-4. These two compounds were not detected above their SSSL in any other wells and as previously stated, show no discernable pattern of contamination.

ADEM Evaluation of Response

It appears that the monitoring well program may not have adequately investigated contamination along the residuum/bedrock interface. Please identify this data gap and present a corrective measure in the revised text.

Final Response: This comment is unresolved.

Comment 23: **Page 2-1, Section 2.2. The document states that groundwater monitoring well HR-118Q-MW02 was constructed as a bedrock monitoring well. The well development log indicates the well development stopped on Day 1 due to rain. On Day 2, well development stopped after one hour, with an increasing turbidity level and a total water volume removed well below the calculated minimum water to be removed listed on page 1 of the well development record. Analysis of the boring and well construction logs indicates the well screen sand pack and choker sand pack extend from bedrock to the residuum with the entire well screen seal material set above the surface of the bedrock. Please clarify if the results from this well were considered for decision-making purposes.**

Response 23: In response to the first part of the comment; yes, the results from this well were used for decision-making purposes. Limestone was encountered at 36.5 feet below ground surface (bgs) with the top of the well screen set at 36.5 feet bgs. Thus, the well screen was installed entirely in limestone bedrock. The actual seal materials (extra fine sand and bentonite) were installed directly on top of the sand pack and well screen starting at 36.5 feet bgs. While it is true that the optimal location for the seal materials would most probably be within the top section of bedrock, unforeseen drilling conditions (i.e. fractures, broken rock zones, flowing sands, increasing groundwater yields, etc.) do exist that alter the final well installation process. Because of these conditions, it took approximately 1.5 months to finally install this bedrock well.

Regarding the second part of the comment, the fact is the well development did fail to remove the minimum volume of water lost in the borehole during drilling and well installation. This was mainly due to the large quantity of water used to install the well. However, the maximum amount of development time of 12 hours was completed in accordance with the Installation-Wide SAP, Appendix C. Additionally, the standard practice for well development is to move the pump up and down the well screen which is probably why an increased turbidity was observed. Furthermore, all field parameters (ph, temperature, conductivity, dissolved oxygen, etc.) reached stabilization with 6 consecutive readings of turbidity measurements less than 10 NTUs during groundwater sampling activities. Additionally, it should be noted that no lead was detected in the groundwater sample collected from this well.

ADEM Evaluation of Response

It appears that well development was not conducted to completion and that the well was constructed partly into both residuum and bedrock layers. Therefore, the integrity of this well as a bedrock monitoring well is questionable. Without adequate development, the respresentativeness of a sample is questionable. Please identify these deficiencies, describe variances from protocols and work plans, and propose corrective action in the revised text.

Final Response: This comment is unresolved.

Comment 24: **Page 2-2, Section 2.2. Please document in the text the rationale for determining which samples were analyzed for lead or metals only.**

Response 24: The sampling rationale were presented in the various site-specific work plans prepared for the BBGR Ranges. Although other metals are present, lead is by far the primary constituent of bullets and is expected to be present in the highest concentrations in the environment. The other metals are expected to be collocated with the lead. Therefore, in an effort to keep investigation costs lower, a number of samples were analyzed for lead only. It was the main objective of the RI to define both the nature and extent of contamination. Therefore, it was in the high lead concentration impact areas where the full TAL metals analyses were targeted to define the "nature of contamination"

present. Lead-only analysis was most commonly used in the peripheral impact areas to help define the "extent" of contamination. Text will be added to Chapter 2.0 for clarification.

Final Response: This comment is unresolved.

Comment 25: **<u>Page 2-2, Section 2.2.</u> Please document in the text the selection process and rationale for samples analyzed for additional analyses.**

Response 25: It has been the general practice during environmental investigations at FTMC historical ranges to analyze 10 percent of the samples for full-suite analyses. The rationale is that these additional constituents are not expected at weapons firing ranges. This information should be added to Section 2.2.

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 26: **<u>Page 2-2, Section 2.2.</u> Please clarify why the XRF screening was applied at only Range 18, Range 20, Range 25 and within the Range 25 safety fan.**

Response 26: XRF was used at Ranges 18, 20, and 25 to further define the extent of contamination where laboratory data indicated "hotspot" lead areas were present. The range safety fans for these ranges were previously characterized during the Bains Gap Road (BGR) Ranges RI. With the exception of Range 25, the BBGR safety fans are oriented toward the east and overlap the BGR safety fans. The only BBGR safety fan that remained uncharacterized was Range 25, which is located north of BBGR and is oriented towards the northeast.

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 27: **<u>Page 2-2, Section 2.2.1.</u> Please provide a summary of the work plan sampling rationale which was referenced in this section.**

Response 27: The sampling rationale was previously provided and can be found in the work plan document *Engineering Evaluation/Cost Analysis Site-Specific Field Sampling Plan for the Baby Bains Gap Road Ranges, January*, 2002 (see list of References in Chapter 9.0 of the RI report).

<u>ADEM Evaluation of Response</u>
Please include a summary of the work plan sampling rationale in the text.

Final Response: This comment is unresolved.

Comment 28: **<u>Page 2-2, Section 2.2.1.</u> Please clarify how the presence of other ordnance, such as mortar shells, affected sample location decisions.**

Response 28: The mortar shells used at Fort McClellan were mostly sand-filled practice rounds, high explosive, smoke, or illumination rounds. Although Shaw conducted UXO avoidance incidental to the RI field investigation, the RI focused on determining the nature and extent of chemical contamination, not UXO. The procedures and Standard Operating Procedures used for UXO anomaly avoidance are outlined in the SAP, Appendix E. In general, if the UXO technician was unable to safely authorize personnel to either enter a proposed sample area or collect an actual intrusive sample, the proposed location was relocated and samples safely collected. Relocating sample locations was done after careful consultation by the site manager and senior UXO technician.

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 29: **<u>Page 2-3, Section 2.2.2.</u> Please clarify how photoionization detector (PID) screening assists in determining the depth at which contamination may be present in the subsurface. Also, please clarify in the text how samples collected in the deepest sample interval above the saturated zone are representative of contamination at shallower depths, especially in the characterizing the nature and extent of potential contamination present in the subsurface.**

Response 29: The soils were screened with a photoionization detector (PID) in accordance with procedures outlined in the final site-specific work plan and SAP. This is standard operating procedure and was done primarily as a precautionary measure to ensure the health and safety of field personnel. The 1-foot to 2-foot bgs soil sample interval is regarded as the upper or first subsurface soil sample interval. Soil samples collected in the unsaturated zone above the water table represent soil conditions. Soil samples collected at or below the water table are representative of groundwater conditions.

Comment 30: **<u>Page 2-3, Section 2.2.2.</u> The document states that "subsurface soil samples were collected continuously to a maximum depth of 12 feet below ground surface (bgs) or until sampler refusal was encountered." Please explain how the depth was selected.**

Response 30: The text will be revised as follows: "Subsurface soil samples were collected continuously to a maximum depth of 12 feet below ground surface (bgs) or until sampler refusal was encountered as outlined in the SAP". The SAP defines surface and subsurface soil sampling procedures and equipment. Soil sampling was performed continuously from ground surface to 12 feet bgs or

until refusal. The surface to 1-foot bgs interval is regarded as the surface soil sample interval. Sample intervals below 1-foot bgs are regarded as subsurface soil samples. The 1-foot to 2-foot soil sample interval is regarded as the upper or first subsurface soil sample interval.

The soil boring logs in Appendix B indicate the depths at which the actual soil samples were collected (start depth and end depth) based upon soil sampling procedures in the SAP.

Final Response: This comment is unresolved.

Comment 31: **Page 2-3, Section 2.2.2. Please clarify why PID screening had such a prominent role in selecting subsurface soil sampling locations at sites where the principal contaminants are non-volatile metals. The selection of subsurface soil samples should address the fate and transport characteristics of all contaminants that could potentially be present.**

Response 31: The soils were screened with a photoionization detector (PID) in accordance with procedures outlined in the final site-specific work plan and SAP. This is standard operating procedure and, at these sites, was done primarily as a precautionary measure to ensure the health and safety of field personnel.

Comment 32: **Page 2-3, Section 2.2.3. Please clarify how the residuum well locations selected can be considered representative of the study area. Also, please provide additional information to justify the well installation locations.**

Response 32: The placement of each residuum monitoring well is outlined in the sample rationale tables in the final site-specific work plans. It should be noted that some monitoring wells were concentrated within areas of visible lead contamination (i.e., berms, impact areas, target mounds, etc.). However, final residuum well locations were determined in the field by the on-site geologist and/or site manager, based on actual field observations, presence of utilities, and UXO clearance.

ADEM Evaluation of Response

Please restate the rationale for well locations in the document and note where and why planned placement changed. This could be accomplished in a matrix table. Please note ADEM remains concerned that certain goals were not or could not be attained with the resulting well network. Please provide additional information to justify the well installation locations. The installation of additional wells may be appropriate to provide additional representativeness in the study area, or to satisfy the goals of the field sampling plan. Please address.

Final Response: This comment is unresolved.

Comment 33: **Page 2-3, Section 2.2.3. Please clarify why no monitoring wells were installed at Range 20. The site background information provided in the report indicates that this range includes areas that have been potentially**

impacted since WWI and that explosives were detonated in pits to simulate artillery impact.

Response 33: The final site-specific work plan did not propose any monitoring wells at Range 20. The various individual work plans were repeatedly discussed throughout the duration of the project and presented to members of the BCT. As noted in the RI Report, prior to November 1999, the entire area encompassing the explosive pits was removed. Stockpiles of removed soil were sampled prior to disposal at various Calhoun County disposal sites. Wells could not be installed in the machine gun impact area due to the steep terrain. However, as discussed during the comment resolution meeting on October 11-12, 2007, two wells were installed in the vicinity of the fenced area as part of a separate investigation for the "Trenches Near Range 20 Firing Line, Parcels 239(7) and 240(7)." These wells did not show evidence of potential site-related impacts to groundwater.

ADEM Evaluation of Response

In the revised document, please restate the rationale for not installing monitoring wells at Range 20 and discuss why groundwater impacts are not expected. Also, please clarify how detonation was accomplished.

Final Response: This comment is unresolved.

Comment 34: **Page 2-3, Section 2.2.3. Please clarify why no monitoring wells were installed at Range 23, Range 25 East, and Range 28.**

Response 34: Four wells were installed at Range 23, including three residuum wells and one bedrock well. Three of the four wells were sampled (one well was dry). Wells were not installed at Range 25 East and Range 28 because these ranges apparently were never constructed. See response to previous comment.

ADEM Evaluation of Response

In the revised document, please restate the rationale for not installing monitoring wells at Range 23, Range 25 East, and Range 28 and discuss why groundwater impacts are not expected.

Final Response: This comment is unresolved.

Comment 35: **Page 2-3, Section 2.2.3. Please document in the text the rationale for not installing wells to evaluate groundwater and any limitations to the investigation.**

Response 35: The Army does not understand this comment. A total of 21 monitoring wells were installed at the BBGR Ranges to evaluate groundwater. Groundwater samples were collected from 19 of the 21 wells (two wells were dry).

ADEM Evaluation of Response

ADEM notes that monitoring wells were not installed at some locations. Please discuss the rationale for not installing monitoring wells and why groundwater impacts are not expected.

Final Response: This comment is unresolved.

Comment 36: **Page 2-3, Section 2.2.3.1. Please include the rationale for determining the location of each residuum monitoring well to ensure that groundwater quality has been adequately characterized.**

Response 36: The rationale for selecting locations for each well were discussed by the BCT during the RI scoping process and subsequently presented in the site-specific work plans.

ADEM Evaluation of Response
In the revised document, please restate the rationale for well locations, and note where and why planned placement changed (where applicable), and whether the objective was obtained.

Final Response: This comment is unresolved.

Comment 37: **Page 2-4, Section 2.2.3.2. Please include the rationale for determining the location of each bedrock monitoring well to ensure that groundwater quality has been adequately characterized.**

Response 37: See response to previous comment.

ADEM Evaluation of Response
In the revised document, please restate the rationale for well locations, and note where and why planned placement changed (where applicable), and whether the objective was obtained.

Final Response: This comment is unresolved.

Comment 38: **Page 2-5, Section 2.2.3.2. The target depth for bedrock well installation specified in the sampling plan was 100 feet. The bedrock wells were installed at depths of 70 to 75 feet. Please include field observations that guided the decision to install the wells at a depth different from that specified in the sampling plan.**

Response 38: The Final Site-Specific Field Sampling Plan states that "it is estimated that bedrock monitoring wells will be installed to an approximate depth of 100 feet bgs; however, actual depths may vary based on ground elevation and lithology observed from the borehole". The main objective of the bedrock wells was to provide information on groundwater quality in bedrock. During the field investigation, bedrock was encountered at shallow depths ranging from 10 feet bgs (HR-79Q-MW03) to 36.5 feet bgs (HR-118Q-MW02). Additionally, the bedrock yielded plenty of groundwater during coring and drilling operations to install the wells with 10 to 20-foot screens to total depths ranging from 70 to 75 feet bgs. It should be noted that lead is the primary contaminant of concern at these ranges. However, lead does not readily migrate from the residuum soils into groundwater at FTMC and, more specifically, is not present in groundwater at the BBGR Ranges.

Comment 39: **<u>Page 2-5, Section 2.2.3.3.</u> The well development log indicates that the minimum amount of water to be removed at well HR-74Q-MW04 was 408 gallons. The amount purged was 237 gallons. Please document this discrepancy and provide justification for the final purge volume.**

Response 39: All monitoring wells were developed in accordance with the procedures outlined in the SAP. Target purge volume is a calculated value that assumes the well will produce sufficient water within the maximum allotted development period specified in the SAP (i.e., 8 hours for residuum wells and 12 hours for bedrock wells). In this case, the time criterion was met before the target purge volume was met. Please refer to Appendix C of the SAP for a detailed discussion on the procedures for well development.

Comment 40: **<u>Page 2-5, Section 2.2.3.3.</u> The well development log indicates that the minimum amount of water to be removed at well HR-79Q-MW03 was 612 gallons. The amount purged was 231 gallons. Please document this discrepancy and provide justification for the final purge volume.**

Response 40: See response to previous comment.

Comment 41: **<u>Page 2-5, Section 2.2.3.3.</u> The well development log indicates that the minimum amount of water to be removed at well HR-84Q-MW03 was 1,707 gallons. The amount purged was 918 gallons. Please document this discrepancy and provide justification for the final purge volume.**

Response 41: See response to Specific Comment 39.

Comment 42: **<u>Page 2-6, Section 2.2.4.</u> Please clarify in the document the suite of analyses specified for groundwater in the range areas to investigate potential contaminants.**

Response 42: This information is provided in Table 2-1.

Comment 43: **<u>Page 2-6, Section 2.2.6 and Page 2-7, Section 2.2.7.</u> Please clarify the basis for selecting the locations for surface water and sediment sampling. Please indicate if the bathymetry and current speed were characteristics of the stream that were used to determine sampling locations.**

Response 43: The rationale for the surface water and sediment sampling locations were presented in the various investigation work plans reported for these sites (see Chapter 9.0, List of References, in the RI report). As noted in the RI report, the actual sampling locations were determined in the field based on drainage pathways and other field observations. The text should be revised to indicate that the sampling locations were also based on the rationale presented in the various work plans.

ADEM Evaluation of Response
Please restate the rationale in the revised document.

Final Response: This comment is unresolved.

Comment 44: **Page 2-6, Section 2.2.6. The document states that the surface water/sediment sample HR-76Q-SW/SD02 was collected from a "temporary pond". Please describe this location in greater detail and explain the objective of this sample location.**

Response 44: The surface water/sediment sample was collected in a pooled area of surface water to determine if contamination exists from possible runoff or releases near Range 20 from former activities in the infiltration training area. This area is located in a deep valley, downgradient of the Range 20 firing area and the machine gun impact zone. The "temporary pond" notation actually appears on the sample collection log rather than in Section 2.2.6. The sample collection team may have perhaps inadvertently used the term "temporary pond" instead of a pooled surface water area.

ADEM Evaluation of Response
In the revised text, please provide a more detailed description of the notation of "temporary pond" and explain the objective of the sample collected.

Final Response: This comment is unresolved.

Comment 45: **Page 2-6, Section 2.2.6. A surface water/sediment sample was not collected from the tributary downstream from the erosional valley where metals were detected above the screening levels in surface soil in the valley and points upgradient. Please address.**

Response 45: See response to Specific Comment 43.

ADEM Evaluation of Response
*In the revised text, please identify the absence of a sample from the tributary as a data gap. Also, additional sampling may be warranted to fully define the contamination in the erosional valley. Please address and include proposal in the revised document.*MDA

Final Response: This comment is unresolved.

Comment 46: **Page 2-6, Section 2.2.6. Please clarify if the evaluation considered several surface water events, such as a storm event which has a greater potential to mobilize and deposit surface contaminants from typical depositional areas.**

Response 46: Again as noted in the RI report, the actual sampling locations were determined in the field based on drainage pathways and other field observations. The "other field observations" would include typical rainfall events. The text will

be revised to indicate that the sampling locations were also based on rainfall events.

Final Response: This comment is unresolved.

Comment 47: **<u>Page 2-6, Section 2.2.6.</u> At Range 25, no surface water/sediment sampling/depositional sampling was completed downstream of known surface soil contamination. Please address.**

Response 47: Disagree. Several depositional soil samples were collected downstream of known surface soil contamination as shown on Figure 4-1.

<u>ADEM Evaluation of Response</u>
Figure 4-1 indicates that no samples were collected from the surface drainage feature extending from the contaminated areas in the northeast boundary of Range 25. In the revised text, please identify this data gap and additional sampling should be proposed as corrective action.

Final Response: This comment is unresolved.

Comment 48: **<u>Page 2-7, Section 2.2.6.</u> Please provide the rationale for selecting each of the surface water sampling locations. Also, please provide an explanation if the location is different from that outlined in the Final Site-Specific Field Sampling Plan.**

Response 48: See response to Specific Comment 43.

<u>ADEM Evaluation of Response</u>
In the proposed text revisions, please describe the rationale for changes in location if different from that outlined in the work plan.

Final Response: This comment is unresolved.

Comment 49: **<u>Page 2-7, Section 2.2.6.</u> Please clarify if surface water metals data were collected on a total (unfiltered) or dissolved (filtered) basis or both.**

Response 49: The text will be revised to indicate that the surface water samples were analyzed for total (unfiltered) metals.

Final Response: This comment is unresolved.

Comment 50: **<u>Page 2-7, Section 2.2.7.</u> Please clarify if leaves, stones, and other materials were excluded from the sediment sampling jars.**

Response 50: The standard operating procedure for sediment sampling is summarized in the FTMC SAP. For chemical analysis, the sample technician will remove material that is not representative of the sampled matrix (i.e., rocks and other vegetative material). This also includes bullets or metal fragments as these are not representative of the sediment sample matrix. If bullets or other

metallic debris is found in the sample, the technician will document its presence on the sample collection log.

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 51: **<u>Page 2-7, Section 2.2.7.</u> Please describe the selection of sediment sample locations.**

Response 51: See response to Specific Comment 43.

<u>ADEM Evaluation of Response</u>
Please restate the rationale in the revised document.

Final Response: This comment is unresolved.

Comment 52: **<u>Page 2-7, Section 2.2.8.</u> Please clarify in the text why only Range 18, Range 20, Range 25, and Range 25 safety fan were screened using an XRF.**

Response 52: See response to Specific Comment 26. Section 2.2.8 explains why XRF was conducted within the study areas at Ranges 18, 20, and 25. Section 2.2.8 will be revised to clarify the purpose of the XRF survey in the Range 25 safety fan.

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 53: **<u>Page 2-8, Section 2.2.8.</u> Please provide a discussion of the XRF screening results and the correlation between XRF screening results and laboratory results or provide a reference to the section of the report where these results are discussed.**

Response 53: Section 4.2 of the report discusses the correlation between the XRF results and the laboratory data. A reference to Section 4.2 will be added to Section 2.2.8.

Final Response: This comment is unresolved.

Comment 54: **<u>Page 2-8, Section 2.4.</u> The document indicated in Section 1.2.2.1 that white phosphorus was used as a tracer for rifle fire. Please clarify why white phosphorus is not being analyzed in subsurface soil, depositional soil, and sediment.**

Response 54: See response to Specific Comment 6.

Comment 55: **<u>Page 2-8, Section 2.4.</u> Please document in this report the rationale for the varying analyses performed for each samples.**

Response 55: Comment noted. Section 2.2 will be revised to provide additional explanation of the rationale for the analytical parameters and frequencies.

Final Response: This comment is unresolved.

Comment 56: **<u>Page 3-1, Section 3.1.</u> The document states that "almost all of the BBGR Ranges are included in the planned U.S. Fish and Wildlife Service (USFWS) refuge, a passive recreation reuse area." Please clarify if "almost all" means all ranges except for Range 18.**

Response 56: According to the *Fort McClellan Comprehensive Reuse Plan* (updated Reuse Map, Rev. March 2000), the majority of the BBGR Ranges are planned for passive recreation reuse. The exceptions are the northern portion of Range 18, which is designated as "Mixed Business Use," and Range 20 and a portion of Range 26, which are within the USFWS refuge area.

Comment 57: **<u>Page 3-15, Section 3.8.1.</u> Please describe the other springs in the area and identify them on a map.**

Response 57: There are no major springs within the BBGR area of study.

Comment 58: **<u>Page 3-16, Section 3.8.1.</u> Please describe whether any industrial, commercial, or agricultural wells are located within a one mile radius of the ranges.**

Response 58: There are no industrial, commercial, or agricultural wells located within a one-mile radius of the BBGR Ranges. Also, as stated in the RI report, there are no potable water supply wells within a one-mile radius of the BBGR Ranges.

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 59: **<u>Page 3-16, Section 3.8.1.</u> Please describe any limitations concerning the regional groundwater gradient.**

Response 59: Regional groundwater flow is discussed in Section 3.8.1 of the BBGR RI Report. The Army does not believe there are any limitations concerning regional groundwater gradient.

Comment 60: **Page 3-16, Section 3.8.1. Please describe in the document the highly variable yields of groundwater from the Floyd/Athens Shale versus the**

Little Oak Newala Limestone, how groundwater flow is influenced from the two different formations, and the resultant impacts on the conceptual site model, including potential preferential migration pathways of contaminants in groundwater.

Response 60: It is unclear how additional groundwater yields and flow will provide any further useful information or understanding of the contamination at the BBGR Ranges. As noted in the RI Report there is no groundwater contamination at the BBGR Ranges. The documents that may provide additional groundwater information in Calhoun County are listed in Chapter 9.0 of the RI report.

ADEM Evaluation of Response

Page 8-3, Section 8.2.3 and Table 4-3 state that concentrations of pesticides and nitroaromatics were detected above human health SSSLs in wells HR-74Q-MW-03, HR-79Q-MW-02, HR-83Q-MW-02, and HR-83Q-MW-03. The text on Page 8-3 attributes this groundwater contamination to isolated, low-level detections. Please analyze groundwater movement and potential preferential pathways in terms of the conceptual site model.

Final Response: This comment is unresolved.

Comment 61: **Page 3-17, Section 3.8.2. The document states that "slug tests were not conducted during the RI. Therefore, hydraulic conductivity values could not be calculated for rising or falling head tests." Please revise this statement to indicate that hydraulic conductivity was not calculated or estimated.**

Response 61: Comment noted. The text will be revised to indicate that the hydraulic conductivity was not calculated or estimated.

Final Response: This comment is unresolved.

Comment 62: **Page 4-1 through 4-16, Section 4.0. Please include in the document the nature and extent of contamination in each environmental media including information on the detection limits for compounds that were not detected to ensure that detection limits were below applicable screening criteria. Also, please include the rationale for determining the number of samples and the analytical suite for each sample.**

Response 62: The nature and extent of contamination in each environmental medium is discussed in Chapter 4.0. Laboratory reporting limits are provided in Appendix G for each undetected constituent (i.e., "U" qualified). The sampling rationale were discussed during numerous BCT meetings and were presented in the various investigation work plans prepared for these sites. These work plans are referenced in Chapter 1.0 of the RI report.

ADEM Evaluation of Response
Please revise the text to identify areas and locations where the full extent of contamination has not been determined. For example, metals contamination at Range 20 has not been fully characterized. Also, please present a corrective action to address these deficiencies.

Final Response: This comment is unresolved.

Comment 63: **Page 4-2, Section 4.1.1. The limited soil sampling completed indicates soils are contaminated with metals at areas within and outside of the machine gun impact zone. The extent of metals contamination at Range 20 has not been delineated. An investigation of the extent of soil contamination needs to be completed to include the entire study area and those areas immediately adjacent where bullets may have migrated from ricochets, misfires, or incidental firing. The infiltration area, where blanks were reportedly used, is in the middle of the firing range. Metal contamination above screening levels is present. Please include the infiltration area to document the extent of site related contamination.**

Response 63: See response to General Comments 3 and 14. Disagree that further investigation is warranted within the infiltration area. The training objective at this range was for soldiers to conduct maneuvers in the infiltration area during overhead live firing. As shown on Figure 2-2 of the RI report, the majority of the infiltration area occupies a low lying area between the machine gun firing points and the hillside impact area farther downrange. Obviously, to ensure personnel safety, the machine gun fire was not directed into the infiltration area but rather at the hillside impact area located further downrange. In fact, it was a regular duty of the range control officer to check the machine gun trajectories to ensure that they were aimed at the proper location (i.e., into the hillside impact zone). Also, as noted in the comment, soldiers training in the infiltration area only used blank ammunition. Therefore, contamination is not expected to be present in the infiltration area.

ADEM Evaluation of Response
Please see the evaluation of response to General Comment 3 and 14. Please note that contamination may be expected in the infiltration area from residue expelled from guns and deposited in the low lying area in front of the hillside of the impact area. This type of residue may contain elevated nitroaromatics and/or metal constituents.

Final Response: This comment is unresolved.

Comment 64: **Page 4-2, Section 4.1.1. Please provide the rationale for why lead concentrations in some site surface soil samples were considered anomalous and why other results were not. A summary table or figure with the lead results along with the concentration ranges for the samples would be beneficial.**

Response 64: As noted in the text, this information is provided in the geochemical evaluation included in Appendix I.

ADEM Evaluation of Response
Please clarify the text by restating the fundamental reasons why lead was determined to be anomalous.

Final Response: This comment is unresolved.

Comment 65: **Page 4-2, Section 4.1.1. Please provide the rationale for analyzing samples for either lead alone or target analyte list (TAL) metals including lead.**

Response 65: See response to Specific Comment 24.

ADEM Evaluation of Response
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 66: **Page 4-2, Section 4.1.1. Please provide information on the correlation between XRF screening results and the laboratory analysis results for lead and justify their use in preparing Figure 4-1.**

Response 66: This information is provided in Section 4.2 of the report. Based on the generally good correlation between the XRF and laboratory data, the XRF data were used to develop the isocontours on Figure 4-1.

ADEM Evaluation of Response
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 67: **Page 4-2, Section 4.1.1. Please include results of sampling from the safety fans on Figure 4-1.**

Response 67: Disagree. Aside from the highest safety fan XRF result of 195 mg/kg mentioned in the text and shown on Figure 2-10, only two other XRF results from the safety fan survey slightly exceeded 50 mg/kg, the lowest contour interval on the figure. The safety fan XRF results are provided in Table 4-6.

ADEM Evaluation of Response
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 68: **Page 4-2, Section 4.1.1. Please provide the range of lead concentrations detected in soil along with the number of samples and/or percentage exceeding a given comparison criteria for the ranges listed in this section.**

Response 68: Agree. A summary table will be added to show comparison of lead values to various screening levels as well as provide the estimated areal extent of contamination at each range.

Final Response: This comment is unresolved.

Comment 69: **<u>Page 4-2, Section 4.1.1.</u> Please provide the range of Laboratory Reporting Limits for the non-detect results at each range area.**

Response 69: These values are included in Appendix G – Summary of Validated Analytical Data as "U"-flagged data.

<u>ADEM Evaluation of Response</u>
Please revise the text to include a statement indicating how the non-detect results compare to screening/comparison criteria.

Final Response: This comment is unresolved.

Comment 70: **<u>Page 4-2 through 4-3, Section 4.1.1.</u> Please include a discussion of exceedances of residential site-specific screening levels (SSSLs) for lead in those sections where each range is discussed. For Ranges 25, 26 and the Ranges South of Range 25, please include a discussion of lead exceedances of the ecological screening values (ESVs). For Range 18, please include a discussion of the exceedances of the industrial SSSL.**

Response 70: As discussed in the response to Specific Comment 68, a summary table will be added to show comparison of lead values to various screening levels as well as provide the estimated areal extent of contamination at each range.

Final Response: This comment is unresolved.

Comment 71: **<u>Page 4-3, Section 4.1.1.</u> Please clarify if pyrotechnics were used at these ranges. If metals detected in soil samples are associated with historic uses of these ranges based on the use of pyrotechnics or other historic activities, then they should not be eliminated from quantitative evaluation in the risk assessments unless they are less than two times the arithmetic mean background level. Please revise the risk assessment accordingly.**

Response 71: Pyrotechnics are not known to have been used at the BBGR Ranges.

Comment 72: **<u>Page 4-5, Section 4.1.1.</u> Please provide a summary of the results of the integrated statistical and geochemical evaluation that supports the conclusion that the cited metals are naturally occurring.**

Response 72: This information is provided in Appendix I, as noted in the text.

ADEM Evaluation of Response
Please include a brief summary regarding the results for the integrated statistical and geochemical evaluation in the report.

Final Response: This comment is unresolved.

Comment 73: **Page 4-5, Section 4.1.1. Please include in the source attribution section a discussion of other contaminants considered "anomalous" and their associated sources.**

Response 73: Agree. Discussions of potential sources of anomalous detected constituents will be added to Section 4.1.1 as appropriate.

Final Response: This comment is unresolved.

Comment 74: **Page 4-5, Section 4.1.1. Please provide a discussion of potential sources of nickel.**

Response 74: Nickel exceeded its ESV and background in two surface soil samples, only one of which was determined to be anomalously high relative to background in the geochemical evaluation. The highest nickel concentrations were detected at Ranges 18 and 25, two of the oldest weapons training ranges at FTMC. The EBS notes that M-1903 Springfield rifles and M-1 Garand rifles were fired at these ranges. From 1906 to approximately 1940, these weapons fired .30-06 Springfield cartridges consisting of copper-nickel jacketed bullets. This information will be added to the text.

Final Response: This comment is unresolved.

Comment 75: **Page 4-5, Section 4.1.1. Guidance cited in the document to support the conclusion that antimony, copper, and zinc are associated with bullets also notes that arsenic contamination could be attributed to lead. Please provide additional information to determine the potential anthropogenic sources of arsenic at the ranges.**

Response 75: Comment noted. The guidance notes that arsenic is present in lead and a small amount is necessary to manufacture lead shot because it improves roundness of the shot. The arsenic results above ESVs and background were collocated with elevated lead results in only about 50% of the locations (8 of 15 locations), which is a lower percentage than the other metals listed in the text. The geochemical evaluation identified only one surface soil arsenic result as anomalous relative to background. Nevertheless, the text on page 4-5 will be revised to include arsenic in the list of metals associated with small arms ammunition.

Final Response: This comment is unresolved.

Comment 76: **Page 4-5, Section 4.1.1. Please list the eleven volatile organic compounds (VOCs) that were detected in surface soil, the probable sources of the detected VOCs, summarize the ranges at which they were detected, and describe where the VOCs were detected relative to the probable source.**

Response 76: The VOCs detected in surface soil are listed in Table 4-1 and the range of detected concentrations for all compounds is presented in the text on Page 4-5. Nearly 93 percent of the VOC detections in surface soil were common laboratory or environmental sample contaminants such as 2-butanone, acetone, methylene chloride, toluene, and trichlorofluoromethane. Based on this and because these are former weapons firing ranges and only one low level, estimated VOC result slightly exceeded an ESV, there is no need to provide an exhaustive discussion of individual constituent concentration ranges and where they were detected relative to a probable source. For clarity, however, a statement will be added that the majority of the detections were common laboratory or environmental sample contaminants.

Final Response: This comment is unresolved.

Comment 77: **Page 4-5, Section 4.1.1. Please provide the range of Laboratory Reporting Limits for the non-detect VOC results.**

Response 77: These values are included in Appendix G – Summary of Validated Analytical Data as "U"-flagged data.

ADEM Evaluation of Response
Please revise the text to include a statement indicating how the non-detect results compare to screening/comparison criteria.

Final Response: This comment is unresolved.

Comment 78: **Page 4-6 and 4-7, Section 4.1.1. Please provide the range of Laboratory Reporting Limits for the non-detect SVOC results.**

Response 78: See previous response.

ADEM Evaluation of Response
Please see previous evaluation.

Final Response: This comment is unresolved.

Comment 79: **Page 4-7, Section 4.1.1. Sample results for SVOCs at Range 26 indicate compounds present above screening levels. Please discuss the rationale for the lack of additional SVOCs samples at the Range to identify the possible source and to determine the extent of SVOC contamination.**

Response 79: As noted in the text, the predominant SVOC contaminants were PAH compounds attributed to creosote-treated railroad cross ties used in

constructing the range. Samples for SVOC analysis were collected from 11 locations at Range 26, including three upgradient locations (HR-84Q-DEP04, HR-84Q-GP15, and HR-84Q-MW02) and two downgradient locations (HR-84Q-DEP01 and HR-84Q-DEP02) of the samples with PAH detections. Based on site topography (see Figure 2-5) and the upgradient and downgradient sample results, the extent of these compounds was defined during the RI.

ADEM Evaluation of Response

Please expand the text on Page 4-19, Section 4.3 to indicate that creosote-treated railroad cross ties are the source of the semivolatile organic compound (SVOC) contamination at Range 26. Also, please revise the text on Page 8-2 to indicate that the polynuclear aromatic hydrcarbons (PAHs) encountered at Range 26 show a pattern such that the source can be attributed to creosote-treated railroad cross ties. Please clarify the text by stating that this surficial contamination will be remediated.

Final Response: This comment is unresolved.

Comment 80: **Page 4-7, Section 4.1.1. Pesticides were detected in groundwater above SSSLs at the one well sampled for pesticides at Range 18. Soils were not analyzed for pesticides with any frequency or pattern. Please address the lack of pesticide delineation.**

Response 80: A total of 70 soil samples were analyzed for pesticides at the BBGR Ranges. The soil data show that the pesticides are present at very low levels consistent with routine application of these compounds for pest control in accordance with manufacturer's and Army guidelines. For perspective, the sum total of all 60 pesticide detections in the 70 soil samples was 0.33 mg/kg. Also, 50 of the 60 detected concentrations were flagged with a "J" data qualifier, indicating that the concentrations were estimated by the laboratory because the levels were below method reporting limits.

ADEM Evaluation of Response

Please expand the text on Page 4-19, Section 4.3 to indicate that pesticide use was the source of the surface soil contamination. Please revise the text on Page 8-2 to state that the pesticide contamination encountered in surface soil and groundwater can be attributed to routine use.

Final Response: This comment is unresolved.

Comment 81: **Page 4-8, Section 4.1.1. Dynamite, trinitrotoluene (TNT), and C4 were used in "explosive pits" at Range 20. Please clarify why there were no samples taken for explosives at these locations.**

Response 81: See response to General Comment 14.

ADEM Evaluation of Response

Please see evaluation of response to General Comment 14.

Final Response: This comment is unresolved.

Comment 82: **<u>Page 4-8, Section 4.1.1.</u> Nitroaromatics were detected in groundwater at Range 25. Please clarify if soil sampling includes parameters to screen for explosive ordnance contamination.**

Response 82: Yes. As shown in Table 2-1, 62 surface and depositional soil samples and 53 subsurface soil samples were analyzed for explosive compounds at Range 25. Explosives were not detected in any of the samples (Table 4-1).

Comment 83: **<u>Page 4-9, Section 4.1.2.</u> Lead results in excess of the soil screening level (SSL) in subsurface soil suggest that the vertical extent of lead soil contamination has not been delineated. Additional sampling and analysis/screening appears to be warranted where lead contamination in excess of comparison criteria was identified. Please address.**

Response 83: See response to General Comment 3.

<u>ADEM Evaluation of Response</u>
Please note that understanding the depth of contamination above cleanup guidelines is essential when evaluating remedial alternatives. If the contamination at depth is above soil screening guidelines in a particular area, then please clarify how deep, for example, one may need to dig to remove the contamination above a particular cleanup level.

Final Response: This comment is unresolved.

Comment 84: **<u>Page 4-9, Section 4.1.2.</u> Please provide the range of lead concentrations detected in soil at each of the range areas cited, along with the number of samples and the percentage exceeding a given comparison criterion. Also, please provide the range of Laboratory Reporting Limits for the non-detect results at each range.**

Response 84: Agree. A summary table will be added to Section 4.1.2 to show comparison of lead values to various screening levels as well as provide the estimated extent of areas impacted.

Reporting limits for non-detects are included in Appendix G – Summary of Validated Analytical Data as "U"-flagged data.

<u>ADEM Evaluation of Response</u>
The Army's response regarding the summary table is adequate and noted. Please revise the text to include a statement indicating how the non-detect results compare to screening/comparison criteria. This information will allow a ready evaluation of the consistency of the results with comparison criteria.

Final Response: This comment is unresolved.

Comment 85: **<u>Page 4-9, Section 4.1.2 and Page 4-10, Section 4.1.2.</u> Please clarify the intent of stating that 14 subsurface soil samples were anomalous and indicative of site-related contamination. If the maximum metals concentration exceeds two times the average background concentration then all concentrations of the metal are considered site-related.**

Response 85: The intent was merely to briefly summarize the results of the geochemical evaluation. Evaluation of background metals at FTMC sites is performed according to a 3-tiered process per agreement by the BCT, including ADEM. The first tier is comparison to two times the background mean as mentioned by the reviewer. The second tier is a set of two statistical tests. Metals that pass the statistical tests generally are not evaluated further. Metals that fail the statistical tests of Tier 2 are carried to Tier 3, which is a geochemical evaluation. The background screening protocol is described in the technical memorandum "Selecting Site-Related Chemicals for Human Health and Ecological Risk Assessments for FTMC: Revision 3" dated March 14, 2005. During recent discussions by the BCT, it was agreed that the geochemical evaluation will be used as one line of evidence in assessing site-related constituents.

ADEM confirmed use of the 3-tiered background screening protocol at FTMC during the October 11-12 comment resolution meeting.

Comment 86: **<u>Page 4-9, Section 4.1.2.</u> Please document in the text the rationale for why lead concentrations in some of the surface soil samples are considered anomalous and why the other results are not. Also, please provide a summary table or figure of those lead results and sample locations that are considered anomalous and those that are not. Also, please include the concentration ranges for the results considered anomalous and those that are not.**

Response 86: This information is provided in the geochemical evaluation included in Appendix I.

<u>ADEM Evaluation of Response</u>
In the revised document, please restate the fundamental reasons why lead was determined to be anomalous.

Final Response: This comment is unresolved.

Comment 87: **<u>Page 4-9, Section 4.1.2.</u> Please clarify the rationale for determining which samples were analyzed for TAL metals analysis and which samples were analyzed for only lead.**

Response 87: See response to Specific Comment 24.

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 88: **<u>Page 4-10, Section 4.1.2.</u> Please provide a summary of the results of the integrated statistical and geochemical evaluation that supports the conclusion that the cited metals are naturally occurring.**

Response 88: This information is provided in the geochemical evaluation included in Appendix I.

<u>ADEM Evaluation of Response</u>
Please include a brief summary in the report.

Final Response: This comment is unresolved.

Comment 89: **<u>Page 4-10, Section 4.1.2.</u> Please clarify why thallium was not discussed in this section when thallium was detected in subsurface soil samples at levels exceeding its SSSL and background concentration.**

Response 89: Thallium was not discussed because it passed the Tier 2 statistical evaluation and was not carried forward into the geochemical evaluation. Thallium will be added to the paragraph after the list of bullets on Page 4-10.

Final Response: This comment is unresolved.

Comment 90: **<u>Page 4-10, Section 4.1.2.</u> Please summarize the range of Laboratory Reporting Limits for the non-detect VOC results.**

Response 90: Laboratory reporting limits are provided in Appendix G for each undetected constituent (i.e., "U" qualified).

<u>ADEM Evaluation of Response</u>
Please revise the text to include a statement indicating how the non-detect results compare to screening/comparison criteria.

Final Response: This comment is unresolved.

Comment 91: **<u>Page 4-10, Section 4.1.2.</u> Please clarify whether subsurface PID screening and sampling was conducted at the locations where VOCs were detected in surface soil samples. Although low levels were detected in surface soils, please clarify if an evaluation of the data was conducted to determine if the presence of low level of VOCs in shallow surface soil is evidence of elevated concentrations of VOCs at depth.**

Response 91: All soil samples were screened with a photoionization detector (PID) in accordance with procedures outlined in the final site-specific work plans and SAP. This is a standard operating procedure and was done primarily as a precautionary measure to ensure the health and safety of field personnel.

Shaw did not await the results of the surface soil samples prior to collecting the subsurface soil samples. The presence of low level VOCs in shallow surface soil was not used as evidence of elevated concentrations of VOCs at depth. The subsurface soil sample data themselves were used for that purpose.

ADEM Evaluation of Response
Please clarify whether field personnel used evidence of surface volatile organic compound (VOC) contamination to guide decisions as to which subsurface soil samples were analyzed for VOCs and at what depth.

Final Response: This comment is unresolved.

Comment 92: **Page 4-11, Section 4.1.2. Please summarize the range of Laboratory Reporting Limits for the non-detect SVOC, pesticide, herbicide, explosives, and polychlorinated biphenyl results.**

Response 92: Laboratory reporting limits are provided in Appendix G for each undetected constituent (i.e., "U" qualified).

ADEM Evaluation of Response
Please revise the text to include a statement indicating how the non-detect results compare to screening/comparison criteria.

Final Response: This comment is unresolved.

Comment 93: **Page 4-11, Section 4.1.2. Please clarify why soil samples were not collected for Total Organic Carbon (TOC) and pH analyses.**

Response 93: No data quality objectives were identified during the RI scoping process and work plan preparation that would require TOC and pH analysis for soil. However, it should be noted that sediment samples were analyzed for TOC and pH measurements were recorded during surface water sample collection (Table 2-5).

ADEM Evaluation of Response
Total Organic Carbon (TOC) and pH are useful for evaluating fate and transport. Please consider collecting these data to aid in such evaluations.

Final Response: This comment is unresolved.

Comment 94: **Page 4-11, Section 4.1.3. Please discuss the rationale used to determine the number of monitoring wells and the analytical suite for each groundwater sample.**

Response 94: The various sampling analytical suites were repeatedly discussed by the BCT during RI scoping and subsequent preliminary data review and discussions.

The rationale and parameters were also provided the site-specific work plans prior to initiating field activities.

<u>ADEM Evaluation of Response</u>
Please restate the rationale for well locations in the document, and note where and why planned placement changed (where applicable). This could be accomplished in a matrix table.

Final Response: This comment is unresolved.

Comment 95: **<u>Page 4-11, Section 4.1.3.</u> Please clarify in the report why it is being concluded that barium, manganese, and thallium are associated with background based on statistical analysis when actual site data indicates that there is a potential for leaching of elevated concentrations of these metals from subsurface soils to groundwater.**

Response 95: This information is provided in the geochemical evaluation included in Appendix I.

Comment 96: **<u>Page 4-11, Section 4.1.3.</u> Please provide the rationale for the different suites of analysis for the monitoring wells. Also, please provide the rationale for sampling only one well for organic compounds and discuss the selection process of this well.**

Response 96: See response to Specific Comment 25. The various sampling analytical suites were repeatedly discussed by the BCT during RI scoping and subsequent preliminary data review and discussions. The rationale and parameters were also provided the site-specific work plans prior to initiating field activities.

<u>ADEM Evaluation of Response</u>
Regarding the reference to Specific Comment 25, please restate the rationale for well locations in the document, and note where and why planned placement changed (where applicable). This could be accomplished in a matrix table.

Final Response: This comment is unresolved.

Comment 97: **<u>Page 4-11, Section 4.1.3.</u> Please document the nature and extent of site related contamination in groundwater at Ranges South of Range 25, Parcels 224Q, and 226Q.**

Response 97: Based on the RI data collected, there is no groundwater contamination at the Ranges South of Range 25.

Comment 98: **<u>Page 4-12, Section 4.1.3.</u> Please document in the text the rationale for concluding that metals detected in groundwater were considered to be naturally occurring.**

Response 98: This information is provided in the geochemical evaluation included as Appendix I of the report.

ADEM Evaluation of Response
Please include a brief summary regarding the Army's response in the text.

Final Response: This comment is unresolved.

Comment 99: **Page 4-12, Section 4.1.3. Please clarify how the monitoring wells are optimally located to detect potential lead/metal contamination. Also, please clarify why only one well is cited near the area of high lead contamination on Main Post Impact Area Parcel 118Q-X and why no wells are located on Range 20, Parcel 76Q-X, where concentrations of lead were detected in excess of the dilution-attenuation factor (DAF_{20}) SSL concentration.**

Response 99: The placement of each monitoring well is outlined in the sample rationale tables presented in the site-specific work plans. Some monitoring wells were strategically placed within areas of visible lead contamination (i.e. berms, target mounds, impact areas, etc.). However, final well locations were determined in the field by the on-site geologist and/or site manager, based on actual field observations, presence of utilities, and UXO clearance.

Comment 100: **Page 4-12, Section 4.1.3. Please clarify why only one well was analyzed for total and dissolved metals.**

Response 100: All groundwater samples were analyzed for total metals. One groundwater sample (from well HR-79Q-MW02) was also analyzed for dissolved metals due to the high turbidity reading (>1,000 NTUs).

Comment 101: **Page 4-12, Section 4.1.3. Please clarify if the Laboratory Quantitation Limits for the SVOC analyses of groundwater were comparable to the residential SSSLs and background screening values.**

Response 101: The laboratory used EPA Method 8270C to analyze groundwater samples for semivolatile organic compounds. In the early planning stages of the Fort McClellan SI and RI program, the FTMC BCT reviewed the reporting limits and detection limits routinely achievable and determined that the methods specified in the FTMC SAP and QAPP were acceptable for meeting the nature and extent of contamination objectives of these investigations.

ADEM Evaluation of Response
Please confirm that the goal was achieved and note it in the report.

Final Response: This comment is unresolved.

Comment 102: **Page 4-13, Section 4.1.3. Please expand the source attribution discussion related to chlorinated pesticides in the document. Please include a discussion on historic uses of the pesticides for the ranges and the general vicinity.**

Response 102: Comment noted. Section 4.1.3 will be revised to indicate that the low levels of pesticides detected in site media are consistent with the routine application of these compounds according to manufacturer's and Army guidelines.

Final Response: This comment is unresolved.

Comment 103: **<u>Page 4-13, Section 4.1.3.</u> Please include a discussion in the document about pesticide contamination in groundwater. The document dismissed the pesticide contamination due to low level detections. However, the pesticide analysis was not completed at all locations.**

Response 103: See responses to Specific Comments 25, 80, and 102. Nine of the 11 detections were "J" flagged as estimated concentrations by the laboratory because the results were below method reporting limits. As stated in response to Comment 102 above, the low levels of pesticides detected in site media are consistent with the routine application of these compounds according to manufacturer's and Army guidelines. Because of this and the low levels detected in site soils as well as the fact that these were small arms ranges, there is no reason to suspect that pesticide concentrations in groundwater elsewhere at the site would be any different. It is worth noting that the human health risk assessment did not identify pesticides as contaminants of concern in any site media at the BBGR Ranges, including groundwater.

Comment 104: **<u>Page 4-13, Section 4.1.3.</u> Please summarize the range of Laboratory Reporting Limits for the non-detect organophosphorus pesticides and chlorinated herbicides.**

Response 104: Laboratory reporting limits are provided in Appendix G for each undetected constituent (i.e., "U" qualified).

<u>ADEM Evaluation of Response</u>
Please revise the text to include a statement indicating how the non-detect results compare to screening/comparison criteria.

Final Response: This comment is unresolved.

Comment 105: **<u>Page 4-13, Section 4.1.3.</u> At Range 23, nitroaromatics were detected in groundwater above the SSSL at HR-79Q-MW02. Please determine the extent of groundwater contamination at Range 23, Parcel 79Q.**

Response 105: See response to General Comment 18.

<u>ADEM Evaluation of Response</u>
Please see evaluation of response to General Comment 18.

Final Response: This comment is unresolved.

Comment 106: **<u>Page 4-13, Section 4.1.3.</u> Nitroaromatics are not included in the groundwater investigation, but are present in the perched groundwater at Parcel 83Q above screening levels. Please address.**

Response 106: See response to General Comment 18.

<u>ADEM Evaluation of Response</u>
Please see evaluation of response to General Comment 18.

Final Response: This comment is unresolved.

Comment 107: **<u>Page 4-13, Section 4.1.3.</u> Nitroaromatics are present in groundwater above the SSSL at HR-79Q-MW02. Please delineate the extent of nitroaromatics in groundwater at Range 23, Parcel 79Q.**

Response 107: This is a repeat of Specific Comment 105 above. See response to Comment 105.

<u>ADEM Evaluation of Response</u>
Please see evaluation of response to General Comment 18.

Final Response: This comment is unresolved.

Comment 108: **<u>Page 4-13, Section 4.1.3.</u> Based on the current understanding of groundwater flow in the unconsolidated material as presented in Figure 3-7, there does not appear to be an upgradient well from monitoring well HR-83Q-MW04 and the downgradient wells are over 500 feet from MW04. Considering that explosives were used at Range 20, located upgradient from HR-83Q-MW04, further investigation is warranted. For HR-79Q-MW02, there are no upgradient or downgradient wells in the vicinity and the off-gradient wells are over 500 feet from MW02. Further data analysis should be conducted to determine if a correlation exists between subsurface soil concentrations of chemicals of potential concern (COPCs) and groundwater impacts. Such analysis is predicated on the availability of subsurface soil sample data for MW02. If no such data is available, further investigation may be warranted to determine whether explosive compounds detected in groundwater are isolated, low-level detections. Please address.**

Response 108: Please see response to General Comment 18. As previously stated, explosive compounds were sporadically detected at low-levels in groundwater and show no discernable pattern of contamination. Additionally, the entire area of Range 20 where the explosives were reportedly used was removed and the soil stockpiles sampled prior to disposal at various Calhoun County disposal sites. The material was subsequently disposed as nonhazardous waste.

There are no subsurface soil explosives data for location HR-79Q-MW02. However, 13 subsurface soil samples were collected from other areas of

Range 23 and analyzed for explosives. Only one compound (2,4-dinitrotoluene) was detected in one sample at a concentration below its SSSL, indicating that explosives have not impacted subsurface soil at Range 23. In fact, the 2,4-dinitrotoluene detection at Range 23 was the *only* explosive compound detected in the 95 subsurface soil samples collected at the BBGR Ranges, providing considerable evidence that no correlation exists between subsurface soil concentrations of explosives and groundwater impacts.

ADEM Evaluation of Response

Please see evaluation of response to General Comment 18. Each potential source area should be evaluated separately from other ranges in order to ascertain whether sources are present in each specific area. As discussed in the comment, there is no information specific to this area that shows that the explosives detected in the groundwater sample is insignificant and not indicative of releases upgradient from 83Q-MW04 and 79Q-MW02. Two explosives were detected in the 83Q-MW04, one 10 orders of magnitude above the SSSL (2,4-dinitrotoluene) and the other 4 orders above the SSSL (2,6-dinitrotoluene). The nearest downgradient well appears to be approximately 800 feet downgradient from this well. There are no wells upgradient from this well. There is insufficient information to determine the extent of contamination at this location. Please address. 4-Amino-2,6-dinitrotoluene was detected at 4 orders of magnitude above its SSSL in 79Q-MW02. There are no wells located upgradient from this well and the nearest well is located approximately 600 feet offgradient. There is insufficient information to determine the extent of contamination at this location. Please address.

Final Response: This comment is unresolved.

Comment 109: **Page 4-14, Section 4.1.4. Please clarify whether surface water analytical results for lead are based on total, recoverable, or dissolved concentrations.**

Response 109: Surface water analytical results are reported as total concentrations.

Comment 110: **Page 4-14, Section 4.1.4. Please provide a summary of the results of the integrated statistical and geochemical evaluation that supports the conclusion that the cited metals are naturally occurring.**

Response 110: This information is provided in the geochemical evaluation included in Appendix I.

ADEM Evaluation of Response

Please see evaluation of response to Specific Comment 72.

Final Response: This comment is unresolved.

Comment 111: **Page 4-15, Section 4.1.5. Please delineate the extent of site related contamination in sediments. Sampling locations leading downstream from Range 20 contain contamination at levels exceeding background and ESV. Migration of contaminants via surface water is demonstrated**

and the extent of contamination via the surface water route is not documented.

Response 111: See response to General Comment 3. Disagree that sampling locations downstream of Range 20 contain contamination. As shown on Figure 4-5, there are three sediment sampling locations downstream of Range 20 (HR-76Q-SW/SD01, HR-223Q-SW/SD01, and HR-83Q-SW/SD01) that do not show evidence of site-related contamination.

<u>ADEM Evaluation of Response</u>
Sampling location HR-76Q-SW/SD03 is downgradient of one arm of a creek that does pass through Range 20 and has elevated levels of copper and lead. Please address.

Final Response: This comment is unresolved.

Comment 112: **<u>Page 4-15, Section 4.1.5.</u> Sampling locations downstream of the safety fan at Range 23 and outside of the study area indicate impact from metals. Please document the extent of contamination from historical site uses.**

Response 112: See response to General Comment 3. Disagree that sampling locations downstream of the safety fan at Range 23 and outside of the study area indicate impact from metals. Downstream sampling locations HR-79Q-SW/SD01 and HR-83Q-SW/SD01 (Figure 4-5) do not show evidence of site-related contamination.

<u>ADEM Evaluation of Response</u>
Samples at HR-79Q-SW/SD02 and SD03 are downstream of the start of the 79Q study area and show impacts for lead and/or copper. Please address.

Final Response: This comment is unresolved.

Comment 113: **<u>Page 4-15, Section 4.1.5.</u> The downgradient depositional samples collected from the two tributaries of Ingram Creek indicate metals contamination above screening levels. Please delineate the extent of contamination present in this surface water pathway.**

Response 113: Disagree. Sample locations HR-83Q-DEP04 and HR-83Q-DEP05 within the Ingram Creek tributaries do not show evidence of site-related contamination. Although the geochemical evaluation identified antimony at HR-83Q-DEP05 as anomalous relative to background, the analytical result was "J" flagged by the laboratory indicating that the result was below the method reporting limit. Also, the concentrations of other expected site-related metals (i.e., lead, copper, zinc) were present at levels consistent with background, further suggesting that the antimony hit was spurious.

Comment 114: **<u>Page 4-15, Section 4.1.5.</u> Please provide a summary of the results for the integrated statistical and geochemical evaluation.**

Response 114: This information is provided in the geochemical evaluation included in Appendix I.

<u>ADEM Evaluation of Response</u>
Please see evaluation of response to Specific Comment 110.

Final Response: This comment is unresolved.

Comment 115: **<u>Page 4-16, Section 4.1.5.</u> Please clarify what is meant by "…may contain a component of contamination…" Given the significant issues associated with the statistical analysis presented in Appendix I, please clarify if the COPCs in sediment are present due to site-related activities and if the maximum concentration for each COPC exceeds two times the background concentration. Also, please clarify if these COPCs were included in the risk assessment.**

Response 115: Trace elements are naturally occurring in soil and sediment, and detected concentrations of some or all of the TAL metals are expected in the site samples. For the specific trace element concentrations in the BBGR data set that were identified as being anomalously high, some portion of those concentrations can be presumed to be naturally occurring. Anthropogenic activities may have added an extra amount of the element beyond that which can be explained due to natural processes. This was determined via comparison of the trace element concentrations to the appropriate reference (major) element concentrations. The addition of anthropogenic element input to the natural element content results in anomalously high elemental ratios, as described in Appendix I. These concentrations are referred to as containing a "component of contamination," because in most cases the element is naturally present in the soil or sediment; there is simply more of it than would be present if historic site activities had not taken place.

The three bulleted metals on page 4-16 exceeded their respective ESVs and background values (i.e., 2X mean background values presented in the Background Metals Survey Report). Of these metals, only copper was determined to be site related and included in the risk assessments.

<u>ADEM Evaluation of Response</u>
Please clearly identify the contamination and exceedances of the elements in the revised text.

Final Response: This comment is unresolved.

Comment 116: **<u>Page 4-16, Section 4.1.5.</u> Please provide support to the statement that "…copper detected in the other site sediment samples is naturally occurring."**

Response 116: This information is provided in the geochemical evaluation included in Appendix I.

ADEM Evaluation of Response
The Army has indicated that the geochemical evaluation is only one line of evidence. Given the presence of copper in surface soils and that "… In addition to lead, three other metals (antimony, copper, and zinc) have been identified as components of bullets. Therefore, the elevated concentrations of copper are frequently collocated in areas with high lead concentrations… (Page 4-5, Lines 21 to 23, Section 4.1.1)." Section 5.2.1 states that "…sediments exhibit impact by antimony, copper, lead, zinc, and a number of VOCs, SVOCs, and pesticides that can be attributed to surface soils." Given the high potential for overland flow to transport copper to stream sediments, please provide adequate justification for the absolute statement that "…copper detected in the other site sediment samples is naturally occurring."

Final Response: This comment is unresolved.

Comment 117: **Page 4-17, Section 4.1.5. Please clarify the possible sources for VOCs in sediment.**

Response 117: Agree. The text will be revised to indicate that the detected VOCs were all common laboratory or environmental sample contaminants.

Final Response: This comment is unresolved.

Comment 118: **Page 4-17, Section 4.1.5. Please clarify if the Laboratory Quantitation Limits for the SVOC analyses were less than the SSSLs and ESVs.**

Response 118: The laboratory used EPA Method 8270C to analyze the sediment samples for semivolatile organic compounds. In the early planning stages of the Fort McClellan SI and RI program, the FTMC BCT reviewed the reporting limits and detection limits routinely achievable and determined that the methods specified in the FTMC SAP and QAPP were acceptable for meeting the nature and extent of contamination objectives of these investigations.

ADEM Evaluation of Response
Please see evaluation of response to Specific Comment 90.

Final Response: This comment is unresolved.

Comment 119: **Page 4-18, Section 4.2. Please provide the rationale for screening only one safety fan. Also, please clarify how 25 samples can be representative of a 1,700-acre safety fan.**

Response 119: Most BBGR range safety fans were sampled as part of the Bains Gap Road (BGR) Ranges RI (Shaw, 2004). The BBGR safety fans are oriented toward the east and the BGR safety fans are oriented south and the fan areas overlap. The only BBGR safety fan that remained uncharacterized was Range 25, which is located north of Baby Bains Gap Road and is oriented towards the northeast.

The Range 25 safety fan was sampled in a manner consistent with all previously conducted RIs at Fort McClellan small arms ranges and discussed and agreed upon by the BCT. The XRF was used to conduct a survey for the presence or absence of lead in the fan. For the reviewer's information, the range safety fans are very large areas that extend well beyond the impact areas and the ranges proper. The shape and size of the safety fans are based on the theoretical maximum distances that the most probable munition used at the range could travel *regardless of topography*. While it is certainly possible that stray projectiles could have been fired into the range safety fan areas through carelessness or incompetence, the likelihood of such occurrences is extremely low. It is simply not practical to sample thousands of acres of range safety fan based on the very low probability of encountering contamination in these areas.

Reference:

Shaw Environmental, Inc. (Shaw), 2004, ***Remedial Investigation Report, Bains Gap Road Ranges, Range 24 Upper, Parcel 80Q; Range 21, Parcel 77Q; Range 22, Parcel 78Q, and Former Mortar Range, Parcel 109Q; and Range 27, Parcel 85Q, Fort McClellan, Calhoun County, Alabama,*** Draft, May.

Comment 120: **<u>Page 4-18, Section 4.2.</u> The limited XRF screening outside of the machine gun impact zone indicates elevated levels of metals are present in soil. Please clarify if further field screening is going to be completed to determine the extent of metal contamination at Range 20, Infiltration Course, Parcel 76Q-X.**

Response 120: Further XRF field screening may indeed be used during any subsequent remedial actions in this area.

Comment 121: **<u>Page 4-18, Section 4.2.</u> Please include the XRF sample location for Range 25 on Figure 2-10. Also, please include justification in the document for the sampling locations. The document states that the highest detection collected along the bank of Cane Creek just north of Range 25 impact zone may not be representative of the safety fan.**

Response 121: Figure 2-10 is intended to show the range safety fan XRF locations only. The XRF sample locations within Range 25 proper are shown on Figure 2-7 of the report. The symbol for XRF sample locations will be added to the legend. The locations and rationale for the XRF samples were provided in the site-specific work plan. Section 2.2.8 briefly describes the rationale for using XRF within Range 25 proper. Section 2.2.8 will be reviewed and additional information regarding the XRF sampling rationale for the Range 25 safety fan will be added.

Final Response: This comment is unresolved.

Comment 122: **<u>Page 4-18, Section 4.2.</u> Please provide more data regarding the XRF Safety Fan Survey of surface soils for decision making purposes. Please clarify how the sample locations targeted the safety fan areas and clarify why there was not any significant quantity or pattern immediately adjacent to the ranges. Please develop a soil screening program for lead to adequately characterize the nature and extent of metals impacted at the Ranges safety fan. If XRF screening is included in this program, a standard operating procedure should be developed and implemented that is consistent with US Environmental Protection Agency (EPA) methods and protocols for XRF field screening. Please address the known interferences that can affect the precision of the XRF instruments, including, but not limited to: sample matrix effects, moisture content effects, sample preparation effects, inconsistent positioning of samples at the probe window, chemical matrix effects, instrument resolution limitations, and proper use of calibration standards.**

Response 122: Range safety fans have been historically investigated as part of the small arms range RIs conducted at Fort McClellan in a consistent manner using methodology suggested to the Army by the EPA Region IV. As stated previously, the range safety fans are very large areas that extend well beyond the impact areas and the ranges proper. The shape and size of the safety fans are based on the theoretical maximum distances that the most probable munition used at the range could travel *regardless of topography*. While it is certainly possible that stray projectiles could have been fired into the range safety fan areas through carelessness or incompetence, the likelihood of such occurrences is extremely low. It is simply not practical to sample thousands of acres of range safety fan based on the very low probability of encountering contamination in these areas. The XRF survey is a cost-effective way to determine whether lead is present or absent in the fans and if additional investigation is necessary. Again, the range safety fan XRF sampling locations were all presented in the approved work plan.

Shaw has used XRF extensively at FTMC and other sites and is aware of the limitations of the method. The FTMC SAP contains an XRF procedure and the analyst follows the standard Shaw corporate SOP for XRF analysis which addresses the above listed concerns.

Comment 123: **<u>Page 4-18, Section 4.2.</u> The supplemental metals delineation at Range 18, 20, and 23 with an XRF was designed to further delineate metal contamination at hotspots. The document stated that the delineation was completed until metals contamination was detected below 400 mg/kg. The sampling location methodology used was linear and resulted in evidence of highly variable contaminant levels, greater than 400 mg/kg. This methodology is not valid for the intended purpose and should only be used to validate a conceptual site model that metals contamination is widespread and the extent of metals contamination has not been determined. Please address.**

Response 123: The Army disagrees with the comment. The supplemental XRF delineation conducted at the BBGR Ranges was successful in gathering more information about the extent of lead contamination around the previously identified lead contamination identified by the laboratory-analyzed samples. The use of XRF data in this manner is consistent with EPA guidance on the appropriate use of XRF screening data. The XRF data were not used in risk assessment.

ADEM Evaluation of Response

Please see evaluation of response to General Comment 3.

Final Response: This comment is unresolved.

Comment 124: **Page 4-19, Section 4.2. Please provide in the text the correlation between XRF screening results and the laboratory analysis results for lead.**

Response 124: This information is briefly provided in Section 4.2 referenced in the comment. Table 4-7 will be modified to include relative percent difference calculations for the XRF and laboratory data and additional correlation details will be added to Section 4.2 accordingly.

Final Response: This comment is unresolved.

Comment 125: **Page 4-19, Section 4.3. Please include in this section a discussion of the use of explosives at Range 20.**

Response 125: Agree. Possible sources of explosives will be discussed in the separate report for Range 20 to be prepared by the Army.

Comment 126: **Page 5-1, Section 5.1. The document states that "metal concentrations were statistically evaluated to distinguish naturally occurring concentrations and statistically insignificant outlier concentrations from concentrations that are attributable to site activities." Please clarify if the metal concentrations stated in this section were exceeding two times the average background concentration.**

Response 126: Clarification has been added to the second paragraph of Section 5.1 on page 5-1. The following text has been added after the first sentence (referred to above) of the paragraph: "As discussed in Appendix I of this report, in the first step of the evaluation, or Tier 1, the maximum detected concentration of each metal was compared to two times the arithmetic mean of background data (SAIC, 1998). Two different statistical tests, or Tier 2 evaluation, are used to determine whether the site concentrations are comparable to background concentrations (Appendix I)." The second sentence of the paragraph has been modified to read "Most metals failed this statistical comparison and required geochemical evaluation." and is now followed by the sentence: "The geochemical evaluation, or Tier 3 evaluation, is based on the natural association between the metal of interest and one or more specific soil forming minerals that concentrate the metal (Appendix I)."

Final Response: This comment is unresolved.

Comment 127: **<u>Page 5-1, Section 5.1.</u> Please include a summary of the fundamental reasons why most metals failed the statistical comparison to background.**

Response 127: Please see response to previous comment and Appendix I of report.

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text. Also, please include information on the outcome of the statistical tests to support statements made in the text.

Final Response: This comment is unresolved.

Comment 128: **<u>Page 5-1, Section 5.1.</u> Please include a summary of the fundamental reasons why most metals detected at the site are naturally occurring.**

Response 128: Please see response to Specific Comment 126 and Appendix I of report.

<u>ADEM Evaluation of Response</u>
Please see previous evaluation of response.

Final Response: This comment is unresolved.

Comment 129: **<u>Page 5-2, Section 5.1.</u> Please correct the typographical error from "injection" to "ingestion."**

Response 129: Agree. The text will be revised per the comment.

Final Response: This comment is unresolved.

Comment 130: **<u>Page 5-2 and 5-3, Section 5.1.1.</u> Please conduct the appropriate calculations using site-specific data to determine an appropriate DAF for each range or for areas within each range having similar hydrogeology. Site-specific DAFs should be calculated for each hydrogeologic setting. Please discuss the applicability of this model to the hydrogeology of these ranges, given that karst features have been identified in the Fort McClellan (FTMC) area. The use of a DAF of 20 is unlikely to be protective in areas where groundwater is present at shallow depths. Also, a DAF of 1 was not derived using the EPA default values presented in this section. Rather, a DAF of 1 indicates that no dilution or attenuation is assumed. Please address.**

Response 130: The Army respectfully disagrees with request for revision to Section 5.1.1. Calculations for each range using additional assumptive data and or modeling to determine site-specific DAFs for each range is not considered appropriate for the BBGR Ranges. Although it is asserted by the reviewer that karst

features have been identified in the Fort McClellan area, none have been identified nor are considered likely present beneath the BBGR Ranges.

The use of the EPA default dilution attenuation factor (DAF) of 20 is an accepted methodology and is considered an appropriate risk screening basis for fate and transport consideration for the BBGR Ranges remedial investigation. EPA selected the DAF 20 basis using a "weight of evidence" approach after considering results applied to over 300 groundwater sites. They conclude that the default values are conservative and likely to be protective for the majority of sites and conditions. As an example, a sensitivity analysis to the affect of a change in source area conducted by the EPA (Appendix A, EPA, 1996) suggested that SSLs are "not particularly sensitive" to a decrease in source area from 30 acres to 0.5 acres. If adsorption or degradation processes are expected to significantly attenuate contaminant concentrations at a site (e.g., for sites with deep water tables or soil conditions that attenuate contaminants), the option exists of using more sophisticated fate and transport models. These options might be considered more appropriate to a feasibility study or other corrective actions.

ADEM Evaluation of Response

The utility of presenting pages on the derivation of a model rather than referring the reader to the EPA guidance is unclear, especially since the default value of 20 is not calculated from the defaults presented. Also, the response does not address that a dilution-attenuation factor (DAF) of 1 is not derived based on the defaults presented. The document presents a derivation of a model instead of information regarding sampling rationale or investigation strategy. Please include more information on the sampling and analytical rationale employed at the site. Also, Page 3-14 indicates that "karst features, including developed caves and sink holes, have been identified in the FTMC area". Please address.

Final Response: This comment is unresolved.

Comment 131: **Page 5-4 to Page 5-5, Section 5.1.1. This assessment is not consistent with ADEM's Alabama Environmental Investigation and Remediation Guidance. Furthermore, there are significant issues associated with this assessment, including the following:**

1. **The depth to groundwater varies across each range and from range to range, therefore assuming a default depth to groundwater is inappropriate.**

2. **No references are provided for critical parameters (e.g., recharge, precipitation, evapotranspiration).**

3. **An adequate demonstration using site-specific data and studies for all ranges is required to show that retardation processes are taking place in each range and hydrogeologic setting.**

4. **Please revise this assessment for the screening evaluation. Please re-evaluate and revise the conclusions that soil concentrations of COPCs are below levels that may result in groundwater contamination and take into account the comments concerning the appropriateness of the DAF_{20} and this assessment.**

Response 131: The Army respectfully disagrees with the request to revise the screening evaluation of Section 5.1.1. In this regard, please see the response to Comment 130 above, and the responses below to the numbered issues presented in Comment 131.

1. Depth to groundwater varies across each range and from range to range. The calculated average depth to water from ground surface to the water table based on all BBGR Range wells (Table 2-4 of the RI report) is 6.53 feet bgs, or 1.99 meters bgs. This value is used in calculating travel time of both organic and inorganic compounds.

2. Equation 5-3 on page 5-4 is used to estimate recharge. Evapotranspiration is assumed to be 60 percent of annual precipitation. Annual precipitation is 53 inches per year. Runoff is estimated at 3.6 inches, using methods in USDA, 1986. Substituting these parameters in Equation 5-3, recharge for the ranges is estimated to be 17.56 inches (0.45 meters) per year.

3. It is not considered necessary to show that retardation processes are taking place in each range. If retardation and degradation processes were not occurring in each range a significantly greater level of groundwater contamination would be present.

ADEM Evaluation of Response
Please provide literature references for the values reported and the justifications of assumptions.

Final Response: This comment is unresolved.

Comment 132: **Page 5-5, Section 5.1.2. Please clarify if the interpretation that soil metal concentrations in excess of a DAF_{20} do not pose a threat to groundwater is based on the site-specific calculated travel times.**

Response 132: Clarification will be made to the text of Section 5.1.2 by inserting the following sentence between the first and second sentence on page 5-6: "However, using an average depth to water table to calculate travel time, these metals apparently do not pose a threat to groundwater due to leaching (Table 5-2)." The beginning of the second sentence will be changed from "However, none of…" to "None of…"

ADEM Evaluation of Response
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 133: **<u>Page 5-5, Section 5.1.2.</u> Please clarify why arsenic was judged to be naturally occurring and not related to site releases.**

Response 133: The maximum arsenic concentration referred to in the first bullet on page 5-5, Section 5.1.2 had a concentration of 36.9 mg/kg (sample HR-83Q-GP18 from Range 25). Although the sample had an elevated arsenic concentration, the sample also exhibited a proportionately higher iron concentration and plotted on a common linear trend for the background samples and most of the site samples. Arsenic in these samples is associated with iron oxides at a ratio consistent with those of background samples, and was therefore judged to be naturally occurring. Rather than present this detail in the first bullet of Section 5.1.2, reference will be made to Appendix I after the second sentence of the bullet: "… geochemical evaluation (Appendix I)."

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 134: **<u>Page 5-6, Section 5.1.2.</u> The document states that metals were not detected at elevated levels in groundwater. Please clarify how this statement relates universally to all the ranges when only a subset of the ranges has had groundwater samples analyzed.**

Response 134: A total of 21 monitoring wells were installed at BBGR Ranges. Only three of the eight ranges and parcels comprising BBGR Ranges – Range 20, Range 25-East and Range 28 – did not have groundwater monitoring wells installed within the actual site boundary. Nevertheless, there are numerous monitoring wells in the general area of these ranges due to the considerable overlapping of the ranges in this area. Based on this and the similar historical uses and contaminants at the BBGR Ranges as well as installation-specific knowledge at other FTMC ranges investigated, it is reasonable to infer that groundwater contamination would not be expected at the three BBGR Ranges where wells were not installed directly within the range boundaries.

<u>ADEM Evaluation of Response</u>
Response noted. Please include the response in the revised text. However, there are still concerns. Some of the monitoring wells do not appear to be optimally located to detect potential lead/metals contamination. For example, only one well is cited near the area of high lead contamination on Main Post Impact Area Parcel 118Q-X. In addition, no wells are located on Range 20, Parcel 76Q-X, where concentrations of lead were detected in excess of the DAF_{20} *soil screening levels (SSL) concentration of 400 mg/kg shown in Table 5-4 of the report suggesting the potential for groundwater impacts. Please address.*

Final Response: This comment is unresolved.

Comment 135: **<u>Page 5-6, Section 5.1.2, and Pages 5-12 to 5-14, Section 5.4.</u> Please clarify the use of a DAF SSL as an appropriate method for screening sediments. Please evaluate the chemicals eliminated based on this comparison.**

Response 135: The use of a DAF SSL is considered an appropriate method for screening sediments. Due to the ephemeral nature of the drainage features at the BBGR Ranges, the transfer mechanisms and chemical transformation would not be too dissimilar to those in surface soils. Substrate of the small tributaries is made up of sand and gravel with very little evidence of fine-grained organic sediment, thus the binding capacity of these sediments is minimal. In the sediment samples, inorganic constituents antimony and lead, and the pesticide alpha BHC exceeded DAF_{20} values; these and other maximum detected concentrations are shown on Table 5-4.

<u>ADEM Evaluation of Response</u>

Migration to groundwater SSLs were developed to model potential leaching of contaminants from soils to groundwater, where drinking water standards are target groundwater concentrations. This is not an appropriate endpoint for a sediment/surface water system. Also, for sediments perennially saturated, a two-phase system is present, not a three-phase system used to derive the DAF SSLs. Please provide supporting documentation on the migration to groundwater SSLs being appropriate for screening sediments. Direct contact soil screening levels should be used for human health receptor screening and sediment benchmarks should be used for screening for ecological community receptors. Please address.

Final Response: This comment is unresolved.

Comment 136: **<u>Page 5-7, Section 5.2.2.</u> Please include in this section site-specific transport mechanisms that are occurring at each range rather than presenting a generic discussion of the types of transport mechanisms that may occur at any given site. Please evaluate the results of the investigation to determine the transport mechanisms, including chemical transformations, which are taking place at each range.**

Response 136: Section 5.2, Migration Mechanisms, is intended as a general discussion of potential routes of contaminant migration that may occur at the BBGR Ranges. The four potential routes bulleted on page 5-6 are considered responsible each to varying degrees for contaminant migration in ranges and parcels comprising the BBGR Ranges. Clarification to the first bullet will be made by adding the word “surface” between the words “or” and “water”. Because of the similarity and overlap among the ranges in surface and subsurface parameters that may affect migration mechanisms, generalizations are only possible as to which process or processes may or may not dominate. However, in response to Comment 136, considerable text revision has been added to Section 5.2.1, and in part to Section 5.2.2 (see response to Comment 137). Chemical transformations that occur at the ranges are still summarized in Section 5.5.5. However, attempting to detail and specifically assign a process as being restricted to one range or another remains beyond the scope of a remedial investigation.

The following text revision beginning with the second sentence of Section 5.2.1 will be made: "Erosion of soil by wind is not considered likely at the majority of BBGR Ranges where the presence of grassy areas and wooded cover exists." This would be especially true for Range 20, Range 25-East, Ranges South of Range 25, Range 28, and parts of Range 25. Small ephemeral tributaries to Ingram Creek drain Ranges 20, 23, 25, 25-East, 26, and Ranges South of Range 25; one of the tributaries that flows across Range 23 is perennial. A small tributary to South Branch of Cane Creek is present at Range 18. Flow in the small tributaries is highly variable and depends on precipitation and surface runoff from the surrounding watershed. There also appears to be some localized contribution to tributary flow from groundwater in areas where the potentiometric surface exceeds the elevation of the tributary bed surface. Flow contribution from groundwater varies according to the amount of precipitation; this transport mechanism appears to be relatively insignificant compared to other transport mechanisms.

Because no constituents were detected at elevated concentrations relative to ESVs and naturally occurring levels in surface water samples from the BBGR Ranges, transport of constituents from groundwater via surface water is not considered significant. Where water erosion is important, sediment and surface water in receiving streams should exhibit contamination by the constituents identified for the surface soil at the site. At both the Contiguous Ranges and Range 18, sediments exhibit impact by antimony copper, lead, zinc, and a number of VOCs, SVOCs, and pesticides (Table 5-1 and 5-4) that can be attributed to surface soils. Sorbed or settled constituents can be transported with the sediments to downstream locations. Analytical results particular to individual ranges are presented in detail in Section 4.0, Table 4-1 through Table 4-6." The last sentence of the section stands as is.

Final Response: This comment is unresolved.

Comment 137: **<u>Page 5-8, Section 5.2.2.</u> The document states that metal-ligand complexes may form that prevent adsorption of metals in the soil water environment. However, no site-specific organic data is presented in the report. Please clarify the basis of this evaluation.**

Response 137: The effect of ligands on the adsorption of cations by soil surfaces can be classified into five categories. In one of the categories, low-molecular-weight organic ligands, sometimes humic in origin, can form soluble complexes with metals and prevent them from being adsorbed or precipitated. The ligand has a high affinity for the cation and although it forms a soluble complex with it, the complex has a low affinity for the soil. Probably the most important ligand that affects cation adsorption is the hydroxide ion. The process of organic complexation and its effects on cation adsorption is difficult to quantify and was presented in the text as a process likely in effect in soil water at the BBGR Ranges.

The reference (Davis et al., 1993) at the end of the first sentence on page 5-8 will be replaced by "(Alloway, 1990; Dragun, 1988)" and the following sentence added to the paragraph: "Total organic carbon content of eleven sediment samples was determined to range from 0.002 to 0.84 percent, suggesting sufficient organic material present in the soil-water system to allow organic-ligand complex formation."

References will be added to Chapter 9 as follows:

Alloway, B.J., 1990, ***Heavy Metals in Soil***, John Wiley and Sons, New York, New York, p. 339.

Dragun, J., 1988, ***The Soil Chemistry of Hazardous Materials***, Hazardous Materials Control Research Institute, Silver Springs, Maryland, p. 458.

Final Response: This comment is unresolved.

Comment 138: **Page 5-8, Section 5.2.2. Rather than attempting to estimate the potential for metals migration/leaching using analytical models and generic property values (e.g., Kd, pH, etc), please evaluate each range with site-specific derived values for the input parameters. Note that leaching tests may also be used instead of modeling. Please address.**

Response 138: The Army respectfully disagrees with re-evaluating the BBGR Ranges using range-specific derived input parameters in order to determine site-specific screening levels for individual chemicals for each of the ranges or parts thereof. The use of EPA default DAF of 20 is an accepted methodology and is considered by the Army a sufficient risk screening basis for fate and transport evaluation in remedial investigations. Calculations for each range using additional assumptive data, leaching tests, and/or modeling is not considered appropriate or necessary. The Army believes it has collected sufficient data to allow evaluation and selection of remedy during the feasibility study process consistent with the requirements of the National Contingency Plan (NCP).

ADEM Evaluation of Response

Leaching tests are relatively inexpensive and could be used in conjunction with the extensive literature based analyses used by the Army as confirmation in select locations. The Department recommends considering this approach at future work at this and other range sites.

Final Response: This comment is unresolved.

Comment 139: **Page 5-9, Section 5.2.2. and Page 5-13, Section 5.4. The document states that "…the metals are either not detected or are at concentrations below background values in surface water and, thus, may not be mobile in the surface water system." Please clarify in the text if there are any data gaps and if further study is needed.**

Response 139: Text cited on page 5-9 and page 5-13 references the analytical results of what is considered by the Army a representative set of surface and subsurface soil and sediment samples from the BBGR Ranges. The selection of location, analytical parameters, number of samples, and other field activities conducted at the ranges at BBGR Ranges is presented in two SI site-specific field sampling plans (IT, 2001a, IT, 2001b) and an EECA site-specific field sampling plan (IT, 2002b). All of these documents and procedures to implement field tasks, etc., were approved by appropriate regulatory authorities. The Army believes that sufficient data is presented in Chapter 5 to support the statement that "… metals are either not detected or are at concentrations below background values in surface water and, thus, may not be mobile in the surface water system.", and the conclusion presented in both the Executive Summary and Chapter 8 of the RI report that no further investigation is warranted to define the nature and extent of contamination at the BBGR Ranges.

Comment 140: **<u>Page 5-12 to 5-15, Section 5.4.</u> The lead SSL is based on ingestion exposure and is not appropriate for use as a DAF SSL. Fate and transport evaluation should take into account the variability in the environmental setting from range to range, such as the depth to groundwater. Please address.**

Response 140: Table 5-2 references in footnote (c) that a soil screening level of 400 mg/kg has been set for lead (EPA, 1994). The reference cited is "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities." A more recent reference, (EPA, 1998), provides clarification to the revised interim guidance document and should also be identified in the footnote. It is agreed that the lead SSL is based on ingestion exposure. Additional discussion is presented in Chapter 6, Streamlined Human Health Risk Assessment, Section 6.1.5.2, and in Chapter 7, Screening Level Ecological Risk Assessment, Section 7.4. Please also refer to the responses to Comments 130 and 131, which address the variability in environmental setting at the BBGR Ranges and fate and transport evaluation.

<u>ADEM Evaluation of Response</u>

The Army's response to ADEM's comment does not address the inappropriateness of using a direct contact screening criteria to determine the potential for leaching of a contaminant to groundwater. The EPA developed two sets of screening criteria that includes one for direct contact and one for migration of a contaminant to groundwater. Please calculate a migration to groundwater SSL for lead.

Final Response: This comment is unresolved.

Comment 141: **<u>Page 6-1, Section 6.0.</u> Please discuss the assumptions and SSSL methodology for the Ranges that are the topic of the RI in this section.**

Response 141: This comment is nearly identical to Specific Comment 103 on the BGR RI report. The Army respectfully continues to disagree that details of the

exposure assumptions and SSSL methodology need to be included in the RI. Reiterating the details of the assumptions and SSSL methodology, which are clearly developed and defended in the Installation-Wide Work Plan, would be unnecessarily laborious, would to some extent defeat the intent of the "Streamlined" Risk Assessment approach that was adopted and approved years ago, and would not increase the protectiveness of the risk assessment. However, we are willing to insert a table summarizing the exposure variable values, and identifying which values are taken from various EPA sources and which values are based on assumptions, referring the reader to the work plan for an explanation of the assumptions.

Final Response: This comment is unresolved.

Comment 142: **<u>Page 6-2, Section 6.0.</u> Please include a summary of improvements made to the manner in which source term concentration (STCs) are estimated. Also, please clarify whether revisions approved since the updated work plan have been included.**

Response 142: The Army respectfully disagrees that a summary is needed at this location in the document. The second sentence below the one in question states, "Changes in protocol are discussed in more detail in their appropriate sections in the remainder of this chapter." Further clarification is provided in Section 6.1.2.4 Estimate Source-Term Concentrations. The first paragraph of this section states, "A minor change from previous SRAs for other sites is the use of one-half the method detection limit (MDL) rather than one-half the reporting limit (RL) as a surrogate concentration for nondetects in the data set of detected chemicals. Use of one-half the MDL yields a more reasonable UCL because the region between the MDL and RL is not double-counted in estimating a surrogate concentration."

Further research reveals that the values reported by the analytical laboratory as MDLs were, in fact, sample quantitation limits (SQL), not MDLs. The text in Section 6.1.2.4 will be revised to correct these terms.

Should the data sets be revised in response to other comments so that STCs need to be recalculated, the most recent version of EPA's ProUCL program will be used.

Final Response: This comment is unresolved.

Comment 143: **<u>Page 6-5, Section 6.1.1.1.</u> Please clarify whether the transport mechanisms discussed in this section are occurring at the Ranges being evaluated or possible transport mechanisms that may occur at any site. Also, if the release and transport mechanisms are documented in Figure 6-1, then clarify why the text indicates that there is uncertainty associated with whether these release and transport mechanisms are occurring.**

Response 143: The purpose of the Conceptual Site Exposure Model (CSEM) is to identify *potential* release mechanisms, transport pathways, exposure routes, etc., whether or not their actual occurrence has been documented, to provide justification for the receptor scenarios and exposure pathways evaluated in the SRA. Its purpose is not to repeat the conclusions of Sections 4 and 5 regarding nature and extent of contamination, or the fate and transport of contaminants. The CSEM provides the basis for identifying and evaluating potential risks to human health in the SRA. The CSEM identifies the receptors appropriate to all plausible site-use scenarios and the potential exposure pathways through which the receptors may be exposed to contaminated media. The elements of the CSEM include the following:

- Source (i.e., initially potentially contaminated environmental) media
- Potential contaminant release mechanisms
- Relevant contaminant transport pathways and media
- Potential exposure media
- Potential receptor scenarios
- Potential routes of exposure (ingestion, inhalation, dermal).

The CSEM for the BBGR ranges is provided on Figure 6-1."

Comment 144: **<u>Page 6-6, Section 6.1.1.2.</u> Please clarify under what circumstances construction work would not take place if the northeastern part of Range 18 is slated for mixed business. Also, please address what is known about future development.**

Response 144: Although it is not certain, it appears that the reviewer may have gained the mistaken impression that part of Range 18 was not evaluated for construction worker exposure. The point of the second paragraph in Section 6.1.1.2 was to declare that all ranges in the BBGR group would be evaluated for each of the four receptor scenarios. To clarify that point, the first sentence of this paragraph will be revised as follows: "Four receptor scenarios (groundskeeper, construction worker, on-site resident, recreational site user) were chosen from the IWWP to evaluate potential human exposure to the environmental media at each of the BBGR ranges separately."

Final Response: This comment is unresolved.

Comment 145: **<u>Page 6-6, Section 6.1.1.2.</u> Considering that young children are more susceptible to lead exposure, please clarify how recreational exposure scenario is protective for young children who may be recreating with their parents.**

Response 145: This comment is similar to Specific Comments 41 and 96 on the BGR RI report. The relevant parts of the responses to these comments, which were accepted as adequate resulting in resolution of the comment, are repeated

here: As noted in the Installation-Wide Work Plan, no attempt was made to develop SSSLs for every plausible receptor; rather, site-use was categorized within a limited number of generalizations; e.g., residential, commercial/industrial or recreational, and SSSLs were computed for the most highly exposed receptor in each generalized site-use category. For example, the resident was the only receptor considered under residential site use, the groundskeeper was the only receptor considered under commercial/industrial site use, and the recreational site user (a youth living nearby) was the only receptor considered under recreational site use. This approach does not mean that no other receptors are plausible. For example, grandchildren may visit a residential site and stay for the summer. Several kinds of workers (other than the groundskeeper), customers and delivery personnel would visit commercial/industrial sites. And adults and children (as well as a youth) might visit a recreational site. Nonetheless, the single receptors chosen for evaluation for each of these scenarios (resident, groundskeeper and youthful recreational site user, respectively) were judged and approved to represent the upper bound on chronic exposure, generally because their exposure frequency is expected to be greater than that for other potential receptors. For the recreational site user, this is based on the assumption that the exposure frequency of a youth is expected to be somewhat greater than that of an adult with adult responsibilities including job, home, and child care. Furthermore, a young child in the age range considered to be more susceptible to lead is likely to be accompanied by a care giver who would supervise the child's activity, reducing the likelihood of incidental soil ingestion. The general principle is that an SSSL that is sufficiently protective for the most highly exposed receptor is also protective for less highly exposed receptors within a given site-use category.

ADEM Evaluation of Response

A youth does not represent the upper bound on exposure for recreational users. A child receptor is the most exposed receptor based on default exposure parameter values, which should be used absent site-specific information. There is no basis for assuming a parent's job, home and child care would limit exposure, as this assumption ignores stay-at-home parents who take their children to a local recreational area to play. A child recreational user is the most reasonable, plausible and most highly exposed receptor and should be the basis for SSSL development. Please address.

Final Response: This comment is unresolved.

Comment 146: **Page 6-6, Section 6.1.1.2. Please provide a reference for the statement that "the game is assumed to be venison because deer are the game species most widely hunted and most likely to contribute significantly to the diet."**

Response 146: The statement in question is a reasonable assumption that permits plausibly quantifying the food-chain pathway. There is no reference for the statement because it is an assumption. It is taken directly from the approved Installation-Wide Work Plan.

ADEM Evaluation of Response

Please provide the reference from the Installation-Wide Work Plan (IWWP) that was used to establish deer as the only game species. Also, please clarify what information formed the basis for this assumption.

Final Response: This comment is unresolved.

Comment 147: **Page 6-6, Section 6.1.1.2. Please present data to support the assumption that there is no lead contamination in areas where sport fish will be consumed. Please include a discussion of whether lead is present in sediment downstream in areas where fish may inhabit the stream and whether lead is partitioning into the surface water.**

Response 147: It appears that the reviewer is concerned about the potential for lead in the aquatic food-chain pathway to affect human health. The presence of lead in downstream media, however, may be a moot point because lead does not bioaccumulate in fish (ATSDR, 2005). Lead is specifically identified as not being of concern for human health through the aquatic food-chain pathways (EPA, 1995). Furthermore, what lead fish may acquire from contaminated sediment or surface water tends to be localized in the mucus on the epidermis, dermis and the gills so that the edible portions generally do not pose a hazard to human health (HSDB, 2007).

Comment 148: **Page 6-7, Section 6.1.1.2. The document states in Section 2.2.2 that "…at those locations where PID readings were below background, the deepest soil sample interval above the saturated zone was submitted for analysis…" Please clarify the discrepancy between the statement in Section 2.2.2 and the statement in this section that "…most subsurface soil samples were restricted to 4 feet bgs because contamination in not expected to reach greater depths."**

Response 148: The comment refers to the last sentence in Section 6.1.2.1, not Section 6.1.1.2. Agreed; the sentence in question in Section 6.1.2.1 will be deleted.

Final Response: This comment is unresolved.

Comment 149: **Page 6-8, Section 6.1.2.2. The tiered approach is used to eliminate metals from further evaluation in risk assessment, which is not consistent with EPA guidance for those metals that are associated with historic activities at the ranges. Please justify that the metals eliminated from further evaluation are not associated with ordnance, propellants, explosives, or other munitions-related items that may have been used at the ranges. Otherwise, please evaluate the metals above Tier 1 level in the risk assessment.**

Response 149: In the context of this comment and response, associated means that the metal in question is related to site activities, not necessarily that its concentration is

increased above background. A site-related metal, on the other hand, is a metal with ambient concentrations above naturally occurring background. The comment implies that metals associated with site activities that fail the Tier 1 evaluation should be included in the risk assessment even though they pass the Tier 2 or Tier 3 evaluation.

The Army respectfully disagrees, believing the tiered approach was developed by the Army and approved by the BCT with the good-faith expectation that discord over background screening and selection of COPCs for inclusion in the risk assessment had been eliminated. Based on recent agreements within the BCT, a Lines of Evidence table will be added to FTMC RI reports. The table will summarize the results of the three-tiered evaluation and also evaluate other lines of evidence (e.g., site history, frequency of detection, nature of spatial distribution, etc.) to support the rationale for including or excluding metals in the risk assessment.

ADEM confirmed the use of the 3-tiered background screening protocol for FTMC during the October 11-12 comment resolution meeting.

Comment 150: **<u>Page 6-9, Section 6.1.2.4.</u> The use of one-half the method detection limit (MDL) is inappropriate for determining representative concentrations and is inconsistent with EPA guidance which requires the use of one-half the sample quantitation limit (SQL) for COPCs that may be present at a site. The MDL does not take into account laboratory dilution that may occur for any given sample. Please provide adequate documentation from the laboratory that shows that each detection limit reported is the method detection limit then one-half the SQL should be considered. Please revise the risk assessment accordingly.**

Response 150: See response to Specific Comment 142.

Comment 151: **<u>Page 6-10, Section 6.1.3.</u> Please discuss the implications of assuming that the data for all of Range 18 are appropriate for a commercial worker in Section 6.2. Given that mixed business development of the northeastern portion of Range 18 is planned, please use an exposure unit (EU) representing data characterizing this portion of the site to evaluate know future exposure scenarios.**

Response 151: Presumably, the last sentence should read, "…know***<u>n</u>*** future exposure scenarios." Future exposure scenarios and EUs are not known and cannot be predicted with accuracy at this time. The approach taken for EU evaluation, however, addresses commercial worker exposure (actually, the groundskeeper is selected as the most heavily exposed commercial worker) regardless of how the EUs are drawn. Therefore, the Army believes that risk to the commercial worker (groundskeeper) and the cleanup values derived from the risk assessment have not been impacted with a non-conservative bias. This is explained more thoroughly in response to Specific Comment 163.

ADEM Evaluation of Response

The general area designated for commercial development is known and should be evaluated as a separate EU. A commercial worker exposure scenario should be evaluated unless it can be demonstrated quantitatively that the groundskeeper exposure scenario is protective of commercial worker exposure. Please address. Please document any assumptions of reduced exposure by the groundskeeper (e.g., less than eight hours of exposure 5 days per week for 50 weeks per year).

Final Response: This comment is unresolved.

Comment 152: **Page 6-11, Section 6.1.5. ADEM's Alabama Risk-Based Corrective Action Guidance Manual requires that the site-wide hazard index (HI) not exceed 1.0. Please revise the risk assessment accordingly.**

Response 152: It is unclear to what issue the reviewer is referring in this comment. Perhaps the reviewer takes exception to the statement that, "An HI greater than 1 is interpreted to mean that the threshold has been exceeded…," preferring to see 1.0 instead of the value rounded to 1. Rounding to 1, however, is consistent with EPA (1989 and 2002) guidance, which suggests rounding risk estimates to one significant figure. Although not stated in the EPA guidance documents, the reason for rounding is so that an unrealistic level of precision is not implied in risk characterization, as would be the case if HI values were presented with two significant figures. All HI estimates include dividing an exposure term by a reference dose (RfD). (In a FTMC SRA, this is accomplished in deriving the SSSLs.) There is a great deal of uncertainty about the exposure term. Also, most RfD values incorporate an uncertainty factor ranging from 100 to 10,000. Implying that the product of two values with such great uncertainty can be expressed to the level of precision implied by two significant figures is mathematically inappropriate.

Furthermore, rounding as implied in Section 6.1.5.1, is not only consistent with EPA guidance, it is consistent with the Installation-Wide Work Plan, which has been accepted by both EPA and ADEM. The BBGR Ranges SRA was not performed under the ARBCA program, but the approved protocol qualifies as a site-specific RM-2 risk assessment under the ARBCA guidance.

References:

U.S. Environmental Protection Agency (EPA), 2002, ***Region 4 Human Health Risk Assessment Bulletins – Supplement to RAGS***, EPA Region 4, Atlanta, Georgia, online.

U.S. Environmental Protection Agency (EPA), 1989, ***Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)***, Interim Final, Office of Emergency and Remedial Response, Washington, D.C., EPA/540/1-89/002.

ADEM Evaluation of Response

According to the Alabama Risk-Based Corrective Action (ARBCA) guidance, the site-wide hazard index (HI) must be less than or equal to 1.0 (two significant digits), not 1. Please revise this paragraph and any calculations where a value greater than 1.0 was used or presented as 1 (i.e., any value up to 1.49 used in calculations as a target hazard quotient or target hazard index rather than 1.0). Please clarify that the Army will use a value of 1.0 to recalculate maximum permissible concentrations.

Final Response: This comment is unresolved.

Comment 153: **Page 6-11, Section 6.1.5.1. Eliminating chemicals with risks below 1E-06 will arbitrarily reduce the overall cumulative risk levels. Several chemicals at 1E-07 will contribute to the cumulative risk estimate above 1E-06 for all chemicals in any particular medium. Please include chemicals with cancer risk estimates below 1E-06 across COPCs or media in the risk characterization. Please revise the risk assessment and conclusions accordingly. Also, please remove risk management statements from this section. This section should be only presenting information on risk estimates. Please address.**

Response 153: This comment raises two issues regarding the second paragraph in Section 6.1.5.1. In the first issue, the reviewer takes exception to the sentence, "Therefore, chemicals that yield ILCR estimates less than 1E-6 are not considered in ILCR sums across COPCs or media." We agree that this sentence is confusing because it refers to risk-based screening, not the summing of cancer risks at the risk characterization stage of the assessment. The sentence adds nothing to the paragraph and should be deleted. However, risk-based screening, in which the maximum detected concentrations of chemicals are compared with their SSSLs based on a cancer risk of 1E-6, will be retained in the protocol. EPA (1989 and 2002) guidance clearly supports risk-based screening for COPC identification and outlines a procedure to do so. Risk-based screening using the SSSLs is described in the approved Installation-Wide Work Plan. Also, it must be noted that the ARBCA guidance supports risk-based screening that eliminates chemicals from the cumulative risk assessment: "The COPCs that do not exceed the PSVs…are no longer a concern. Only the chemicals that exceed the PSVs…are used to assess the cumulative risk…" (page 5-3 of ARBCA guidance).

In the second issue, the reviewer requests removing all risk management statements. The Army contends that there are no risk *management* statements in this section. However, as noted in the first sentence in this paragraph, *policy regarding interpretation* of cancer risk levels must be understood in order to know which chemicals to categorize as chemicals of concern (COC) for cleanup level estimation. No place in this section is it suggested how risks should be *managed* (e.g., whether or how they should be avoided or reduced).

References:

U.S. Environmental Protection Agency (EPA), 2002, ***Region 4 Human Health Risk Assessment Bulletins – Supplement to RAGS***, EPA Region 4, Atlanta, Georgia, online.

U.S. Environmental Protection Agency (EPA), 1989, ***Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)***, Interim Final, Office of Emergency and Remedial Response, Washington, D.C., EPA/540/1-89/002.

ADEM Evaluation of Response

Please clarify whether COPCs that exceeded the initial screening were dropped prior to calculating cumulative site risks because at the risk characterization stage, the chemical's individual cancer risk in a particular medium was less than 1E-6.

Final Response: This comment is unresolved.

Comment 154: **Page 6-14, Section 6.1.5.2. Please clarify whether the lead screening level of 880 mg/kg is a site-specific value or represents EPA's default value for an adult worker. If the latter, the default value is 780 mg/kg, rounded to 800 mg/kg. If the former (i.e., a site-specific value), please provide documentation for the derivation of this value. The SSSL Report only references 880 as EPA's default value. Please revise the risk assessment and conclusions accordingly.**

Response 154: This comment is similar to a portion of Specific Comment 41 on the BGR RI report. The relevant part of the response to this comment, which was accepted as adequate resulting in resolution of the comment, is repeated here: The basis for the reviewer's statement that the current EPA acceptable lead concentration in soil for the adult worker is 780 mg/kg is unclear. The current EPA (2004) Region 9 PRG for industrial soil is 800 mg/kg attributed to a recent analysis of NHANES III. The industrial soil PRG in the EPA PRG table in 2000 was 750 mg/kg, attributed to the EPA (1996) adult blood lead model. The information provided by EPA in the 2002 and 2004 PRG tables is insufficient to permit further explanation of these computations. The SSSL for lead in industrial soil of 880 mg/kg is read directly from the graph in Figure 1 of the description of the adult blood lead model relating fetal blood lead concentration to the concentration of lead in soil for a heterogeneous population (EPA, 1996). From a practical perspective, there is no significant difference between these three values.

The SSSL Report does not reference 880 mg/kg as "EPA's default value." Instead, it states, "The EPA (1996a) adult blood lead model estimates a lead concentration in soil of approximately 880 mg/kg as the level below with the 95th percentile fetal blood lead concentration would not exceed 10 µg/dL. The 880 mg/kg concentration is adopted as the SSSL for lead in soil for the groundskeeper and construction worker."

References:

U.S. Environmental Protection Agency (EPA), 2004, ***Region 9 PRG Table***, San Francisco, California, October.

U.S. Environmental Protection Agency (EPA), 2002, ***Region 9 PRGs Table***, San Francisco, California, October.

U.S. Environmental Protection Agency (EPA), 1996, ***Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil***, Technical Review Workgroup for Lead, December.

ADEM Evaluation of Response

The use of a value read from a graph from a figure from an out-dated reference (the final version is dated January 2003) rather than using the more recent criteria developed by EPA using the Adult Lead Model is inappropriate. For a heterogeneous population using EPA's default parameters, the criterion is 780 mg/kg. This value should be used as the SSSL for adult-only exposure. Please address.

Final Response: This comment is unresolved.

Comment 155: **Page 6-14, Section 6.1.5.2. A cleanup level should be developed based on a child exposure in accordance with EPA guidance. The guidance provides methodology for developing a cleanup standard for lead that is considered protective of a child exposed during intermittent recreational activities. Please assume that a child will roam over the highest lead contaminated area for each range. The representative concentration calculated for this EU can then be compared to a cleanup level protective for children. Please clarify why the proposed cleanup level for a recreational user exceeds the acute criterion for lead in soil.**

Response 155: This comment raises two issues. In the first, the reviewer requests developing a cleanup level for lead in soil for recreational site use based on childhood exposure instead of the youth recreational site user, noting that EPA (2003) provides guidance for this kind of estimation. As noted in response to Specific Comment 145, adults and children, as well as a youth, indeed might visit a recreational site. Nonetheless, the single receptor chosen for evaluation for this scenario, the youthful recreational site user, was judged and approved to represent the upper bound on chronic exposure based on the assumption that the exposure frequency of a youth is expected to be somewhat greater than that of an adult with adult responsibilities including job, home, and child care. Furthermore, a young child in the age ranged considered to be more susceptible to lead is likely to be accompanied by a care giver who would supervise the child's activity, reducing the likelihood of soil incidental ingestion. A similar response to a similar comment on the BGR ranges RI (Specific Comment 41) was accepted as providing complete resolution.

In the second issue, the reviewer asks why the proposed cleanup level for lead in soil for the recreational site user (7.60E+3 mg/kg) exceeds the acute criterion for lead in soil for the child (6.50E-3 mg/kg). The acute criterion presented in the document is a transcription error; the correct value is 6.50E+3 mg/kg. The Army agrees with the implications of the reviewer's question. It is entirely reasonable that a young child occasionally may visit a recreational area, albeit less frequently than the youthful recreational site user. Therefore, the acute criterion for the child of 6.50E+3 mg/kg should be adopted as the cleanup level for lead in soil for recreational site use.

Reference:

U.S. Environmental Protection Agency (EPA), 2003, ***Assessing Intermittent or Variable Exposures at Lead Sites***, Office of Solid Waste and Emergency Response, EPA-540-R-03-008, OSWER # 9285.7-76, November.

ADEM Evaluation of Response
Please see evaluation of response to Specific Comment 145.

Final Response: This comment is unresolved.

Comment 156: **Page 6-15, Section 6.1.5.2. Please provide adequate documentation to demonstrate that the cleanup level for lead of 7,600 mg/kg is protective of children exposed to soil and sediment using current EPA guidance.**

Response 156: Please see response to previous comment.

ADEM Evaluation of Response
Please see evaluation of response to Specific Comment 145.

Final Response: This comment is unresolved.

Comment 157: **Page 6-15, Section 6.1.5.2. The action level of 0.015 mg/kg is a Treatment Technique (TT) and is not health-based. Therefore modification of this value using health-based exposure assumptions is not appropriate. The action level of 0.015 mg/L should be used as the cleanup level for surface water for the recreational site user. Please address.**

Response 157: This comment is similar to Specific Comment 107 on the BGR RI. The response to the BGR comment, citing EPA (1989) guidance showing how exposure scenarios are adjusted, was accepted as providing resolution of the comment. The fact that the action level is based on treatment technology rather than health effects should make no difference. The fact remains that the recreational site user would be exposed to surface water far less than a resident would be exposed to potable water in his home. Therefore, the acceptable concentration of lead for drinking water, whatever its basis, should be adjusted accordingly. Adoption of an unadjusted action level for tap water

as a cleanup level for surface water in a stream intuitively seems unnecessarily restrictive.

Reference:

U.S. Environmental Protection Agency (EPA), 1989a, ***Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)***, Interim Final, Office of Emergency and Remedial Response, Washington, D.C., EPA/540/1-89/002.

ADEM Evaluation of Response

Where the initial value is risk-based (i.e., calculated based on its toxicity and residential exposure parameter values), adjusting it for recreational exposure as outlined above is appropriate. However, the action level for lead in groundwater is not risk-based. It is based on economic and technical feasibility considerations. Therefore, as stated in the original comment, the methodology used to derive the surface water cleanup level is not appropriate. The Integrated Exposure Uptake Biokinetic (IEUBK) model should be used to calculate media-specific remediation goals. Please address.

Final Response: This comment is unresolved.

Comment 158: **Page 6-15, Section 6.1.5.2. Please verify the acute criterion for lead. If it is indeed 6.5E-03 mg/kg and this value should be applied as a not-to-exceed value for residential soil, then this value should be the SSSL rather than 400 mg/kg. Please revise the risk assessment and conclusions accordingly.**

Response 158: The acute criterion for lead in soil of 6.5E-3 mg/kg is a transcription error, as noted in response to Specific Comment 155. The correct value is 6.5E+3 mg/kg. The acute criterion for lead in soil of 6.5E+3 was an informal communication from Ted Simon, Region 4, to P. Goetchius, Shaw E&I in 2003. The acute criterion should indeed be applied as a not-to-exceed value for residential soil, because it is based on a single exposure event that could occur at any location on the site. The acute criterion, however, should not be substituted for the SSSL of 400 mg/kg because the SSSL is based on chronic exposure and would be applied as the average concentration over the entire exposure unit.

Comment 159: **Page 6-17, Section 6.1.6. Please provide specific references for the statement that "lead fragments in soil degrade, albeit very slowly…" The rate at which lead fragments degrade is dependent on pH, eH, the presence of carbonate, sulfate, sulfide, phosphate and chloride, and the organic matter content of the soil. Also, the document states "… it is not possible to predict the rate or the concentrations of lead in soil that may occur." Please revise the document accordingly.**

Response 159: The references for the first statement, "…lead fragments in soil degrade, albeit very slowly…" requested by the reviewer are appropriately included in

parentheses at the end of the sentence. The statement, "… it is not possible to predict the rate or the concentrations of lead in soil that may occur" is a conclusion drawn from the foregoing that requires no reference.

Comment 160: **<u>Page 6-18, Section 6.2.1.2.</u> Please clarify why nickel is not included in the list of those metals associated with bullets, and why there is no apparent explanation for the presence of nickel at Range 18 when nickel is associated with the coating on some lead shots.**

Response 160: Agreed; nickel is associated with the coating on some lead shot. The sentence in question and the following sentence will be revised as follows: "Site-related metals in surface soil include those associated with bullets and shot (antimony, arsenic, copper, lead, nickel, zinc) as well as beryllium. No explanation is apparent for the presence of beryllium as a site-related metal."

Final Response: This comment is unresolved.

Comment 161: **<u>Page 6-22, Section 6.2.1.4.</u> Although numerous samples were collected in soil, the various analyses selected limited the analytical data obtained from any given sample. Hot spots are not considered. Also, numerous modifications were made to the SSSLs to reduce their conservative bias. Please address. Also, please evaluate the areas where sample concentrations exceed the applicable cleanup levels for remedial options.**

Response 161: Several issues are mentioned in this comment. Regarding the first issue, limitations regarding the sampling and analysis program are addressed in Section 6.1.6. Regarding the second issue, hot spots are not identified and addressed directly, but the comparison of COPC concentration at each sample location with the receptor-specific cleanup level accomplishes the same purpose. Regarding the third issue, the SSSLs are conservative screening levels developed for COPC identification. They are not intended to be applied as cleanup levels; however, they can serve as the basis for cleanup level development because they incorporate the toxicity assessment and all the exposure assumptions of the receptor of interest. The fourth issue is unclear; the evaluation that was performed consists of identifying, for each receptor and each COPC, those sample locations where the ambient concentration exceeds the cleanup level (e.g., Tables 6-26 through 6-29 for Range 18).

<u>ADEM Evaluation of Response</u>

Please clarify what is meant by "those sample locations where the ambient concentration exceeds the cleanup level." For a current recreational user, six sample locations were identified as exceeding the site-specific cleanup level, yet no action is being considered because the average concentration for Range 18 did not exceed the cleanup standard. Please clarify the utility of conducting a sample by sample comparison if the end result is that no action is recommended because the average concentration is below the cleanup level.

Final Response: This comment is unresolved.

Comment 162: **<u>Page 6-22, Section 6.2.1.4.</u> A comparison of the average concentration over an EU may be appropriate where receptor activities are well documented and concentrations are not significantly variable. In the case of recreational exposure, the EU is uncertain as is the actual activities that may be conducted by recreational receptor. Hotspots were not evaluated; rather concentrations spanning two orders of magnitude were averaged, resulting in dilution of potential hot spot areas. For those COPCs where a comparison of the average site concentration to the cleanup level is the basis for concluding that there are no unacceptable risks, remedial action may be needed if the maximum concentration of a COPC exceeds the average by a factor greater than 10. Please address.**

Response 162: This comment raises several distinct but related issues. Each issue is addressed individually, and then the implications of the comment as a whole are discussed.

First, the reviewer implies that it is not appropriate to compute the source-term concentration (STC) as an average over an entire EU where receptor activities are not well documented and concentrations are significantly variable. In response, it is noted that the activities of *all* future receptors are largely unpredictable, yet EPA (1989, 2002) recommends an averaging technique. It should be noted, however, that the STC (for chemicals other than lead) is generally the upper confidence limit (UCL) on the mean rather than the mean itself. Application of the UCL procedure captures the uncertainty about data sets with large amounts of variance and increases the UCL on the mean accordingly.

Second, the reviewer notes that hot spots were not evaluated. It is correct that specific data subsets designated hot spot areas were not evaluated separately at the risk characterization step of the assessment. In fact, several hot spots could be hypothesized and evaluated, depending on the number of samples included and how the hot-spot boundaries were gerrymandered, but that approach would be unnecessarily laborious and the number of tables in the document would be greatly increased. The streamlined approach, taken herein, identifies all sample locations where the concentration of any COPC exceeds its cleanup level. This approach effectively accomplishes an EU evaluation with much less effort and fewer tables.

The foregoing is illustrated using the construction worker at Range 18 exposed to total soil and groundwater. COPCs identified for the construction worker in total soil include antimony, arsenic, copper and lead (Table 6-11). All of the COPCs in total soil reflect surface soil contamination (Table 6-9); no chemicals in subsurface soil were identified as COPCs for the construction worker (Table 6-10). No chemicals were identified as COPCs for the construction worker in groundwater (Table 6-16). The cumulative cancer risk and cumulative HI across chemicals and media (limited to total soil) were 8.06E-7 and 5.88E-1, respectively (Table 6-17). By this assessment, the construction worker scenario "passed" the risk assessment; therefore, it would

seem unnecessary to identify COCs and develop cleanup levels. However, the following text appears in Section 6.2.4.1 Risk Characterization – Lead:

> "As noted above, an EU for the construction worker would probably be much less than the entire area of Range 18. Lacking more definitive data for EU identification, COPC concentrations in individual samples were compared with their cleanup levels (Table 6-28). Concentrations of lead in 13 surface soil samples exceed the cleanup level. However, no concentrations of antimony, arsenic or copper exceed their cleanup levels. It is concluded that lead in surface soil raises concern for noncancer health effects for the construction worker exposed to total soil and groundwater at Range 18."

In this manner, *all* locations that might be harmful for construction worker exposure were identified without evaluating any number of hypothetical EUs.

Shooting ranges lend themselves particularly well to this kind of evaluation because the contaminants are generally metals and their distributions are usually correlated. The geochemical evaluation used in the background evaluation is essential to identify precisely which sample locations are contaminated and which are not.

Thirdly, the reviewer suggested, in the absence of an EU evaluation, that remedial action may be needed if the maximum concentration of a COPC exceeds the average by a factor greater than 10. No information was provided, however, to show that a factor of 10 would be sufficiently protective, or that it would not be unnecessarily restrictive. This is a moot point, however, given the explanation of the streamlined approach given above.

In summary, the wide variation in contaminant concentrations and the absence of a typical EU evaluation did not compromise the protectiveness of the risk assessment because every location where the concentration of any COPC exceeded its cleanup level was identified.

References:

U.S. Environmental Protection Agency (EPA), 2002, ***Region 4 Human Health Risk Assessment Bulletins – Supplement to RAGS***, EPA Region 4, Atlanta, Georgia, online.

U.S. Environmental Protection Agency (EPA), 1989, ***Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)***, Interim Final, Office of Emergency and Remedial Response, Washington, D.C., EPA/540/1-89/002.

ADEM Evaluation of Response

The original comment relates to the risk assessment, rather than the comparison of COCs to cleanup levels. Chemicals are dropped from comparison to cleanup levels if their STC is less than the SSSL. The STC is calculated as an average of datasets over large EUs. The use of such large datasets dilutes high concentrations of chemicals. This dilution could result in the elimination of chemicals from the list of COCs compared to cleanup levels. Also, although COCs are compared to cleanup levels on a sample by sample basis, if the average concentration is below the cleanup level, then the Army concludes that no action is warranted, making the sample by sample comparison meaningless. An average masks potential hot spots that should be evaluated separately. Please address.

Final Response: This comment is unresolved.

Comment 163: **Page 6-23, Section 6.2.1.4. It is inappropriate to define the EU as the entire range for the groundskeeper for Range 18, since the groundskeeper is being used to characterize a commercial receptor. Please evaluate the area slated for commercial development as a separate EU, and also evaluate the lead concentrations exceeding the appropriate commercial/industrial cleanup level for remedial options within this EU in addition to the EU representing the remaining portion of Range 18.**

Response 163: The exact area slated to be developed for commercial use is currently unknown, so an actual EU cannot be determined. True, the groundskeeper is a surrogate for all commercial/industrial receptors, as stated in the approved work plan, because a groundskeeper would be more intensely exposed than other commercial/industrial receptors. A groundskeeper working full time, however, would be expected to care for a very large area. Therefore, the exposure assumptions for a groundskeeper exposed to a smaller EU would have to be factored downward commensurately (e.g., an exposure frequency of one-half day per week?). The data currently available are not sufficient so that refining the exposure assumptions would be anything better than mere speculation. Other commercial/industrial receptors most likely would be indoor workers who would be exposed much less intensely than the groundskeeper. The approach taken in the approved work plan was not to develop separate exposure assumptions and SSSLs for the indoor worker, but to apply the groundskeeper scenario as described above to represent all site workers.

Because the exact area slated to be developed for commercial use is currently unknown, it is impossible to separately evaluate lead concentrations that exceed the commercial/industrial cleanup level. However, as was noted in response to the previous comment regarding the construction worker, each of the 13 sample locations where the concentration of lead exceeded the commercial/industrial cleanup level has been identified (please see Table 6-27). This information is available for when the actual area to be developed is determined (or the information may be used to help determine the area).

ADEM Evaluation of Response
The Army's response does not address chemicals other than lead for commercial/industrial receptors. Please address. Also, please clarify whether a fraction of exposure (FI) less than 1 was used for the groundskeeper SSSLs used at Baby Bains Gap Road (BBGR).

Final Response: This comment is unresolved.

Comment 164: **Page 6-23, Section 6.2.1.4. The use of 1.49 as the target HI is not appropriate for calculating SSSLs. For each route of exposure, the site-wide HI must be less than or equal to 1.0. Furthermore, the use of 1.49 is inconsistent with the target HI presented in the SSSL Report of 1.00 E+00. Please revise the risk assessment for all ranges accordingly.**

Response 164: This comment is identical to Specific Comment 112 on the BGR RI report. The response to that comment, which was accepted, is repeated here: A target HI of 1, not 1.49, was used to calculate SSSLs. However, a target HI of 1.49 was used to calculate cleanup levels from the SSSLs because the cumulative HI for a given mechanism of toxicity (with target organ or target tissue as a surrogate for mechanism of toxicity), rounded to one significant figure, would not exceed the threshold of 1. Nonetheless, as requested by the reviewer, a target organ HI of 1 will be used to revise the calculated cleanup levels.

ADEM Evaluation of Response
Please note that if a value of 1.0 will be used for calculating cleanup levels, then the response is adequate.

Final Response: This comment is unresolved.

Comment 165: **Page 6-25, Section 6.2.1.4. The total cancer risk of 6.96E-05 exceeds ADEM's Alabama Risk-Based Corrective Action Guidance Manual cumulative cancer risk level of 1E-05, indicating unacceptable risk. Please include this in the text and revise the conclusions accordingly.**

Response 165: The issue raised in this comment is the same as Specific Comment 105 on the BGR RI: "ADEM requires that cumulative site risk not exceed 1E-05. Also, ADEM requires that the site-wide hazard index (HI) not exceed 1.0." The response to this comment, which was accepted, is repeated here: "The site-specific work plan and all previous FTMC risk assessments followed EPA (1989, 1990, 2002) guidance, which identified cancer risk of 1E-6 to 1E-4 as the risk management range, and permits refining the cumulative HI so that no "target organ" HI exceeds the threshold level of 1." Accordingly, a total cancer risk of 6.96E-05 does not constitute an unacceptable risk.

References:

U.S. Environmental Protection Agency (EPA), 2002, ***Region 4 Human Health Risk Assessment Bulletins – Supplement to RAGS***, EPA Region 4, Atlanta, Georgia, online.

U.S. Environmental Protection Agency (EPA), 1990, "National Oil and Hazardous Substances Pollution Contingency Plan," ***Federal Register*** 55(46): 8666-8865.

U.S. Environmental Protection Agency (EPA), 1989, ***Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)***, Interim Final, Office of Emergency and Remedial Response, Washington, D.C., EPA/540/1-89/002.

Final Response: This comment is unresolved.

Comment 166: **Page 6-27, Section 6.2.1.6. Please clarify in the text that the groundskeeper is considered to be representative of a commercial worker. Please revise this section to reflect the two EUs applicable to Range 18, one for the area slated for commercial development and one for the remaining portions of the range.**

Response 166: Please see response to Specific Comment 163 above.

ADEM Evaluation of Response
Please see evaluation of response to Specific Comment 163.

Final Response: This comment is unresolved.

Comment 167: **Page 6-28, Section 6.2.2. The portion of Range 20 within the security fencing was not investigated. Therefore, please clarify in the document that the investigation and risk assessment results only apply to soil outside the fenced area. The lack of soil data within the area where past use of explosives occurred is a significant data gap for the remedial investigation and risk assessments. Also, the lack of groundwater data for Range 20, where explosives were used, is a significant data gap. Please clarify in the document if further investigation is needed to adequately characterize soil and groundwater at Range 20.**

Response 167: See response to General Comment 14.

ADEM Evaluation of Response
Please see evaluation of response to General Comment 14.

Final Response: This comment is unresolved.

Comment 168: **Page 6-29, Section 6.2.2.1. Please rephrase the sentence which begins with "It was thought…" Explosives were detected in a downgradient well, HR-83Q-MW04, and further investigation is needed to determine the source for the explosives.**

Response 168: See response to General Comment 14. The sentence in question is in error. Range 26 in not located downgradient of Range 20 but rather sidegradient. Monitoring well HR-83Q-MW04 is also located somewhat sidegradient of Range 20 but is approximately 1,600 feet away adjacent to Range 25. Explosives were not detected in the five other wells at Range 25. The sentence will be deleted.

Final Response: This comment is unresolved.

Comment 169: **<u>Page 6-34, Section 6.2.2.5.</u> According to Figure 3-7, groundwater flow is to the north/northeast toward Range 25 East and Range 28. Please provide adequate documentation for the statement that Range 26, located south of Range 20, is downgradient from Range 20. Please note in the document that explosives were detected in well HR-83Q-MW04, which based on the groundwater elevation map, is downgradient from Range 20. Historical evidence indicates that Range 20 is the only range where explosives were used. Please revise the results for the risk assessment for Range 20 accordingly.**

Response 169: See previous response.

Comment 170: **<u>Page 6-34, Section 6.2.2.6.</u> Please clarify whether the security fence will be removed prior to reuse for recreational purposes. A baseline risk assessment should not take fencing into consideration in the evaluation of potential exposures by future receptors.**

Response 170: It is expected that the security fence will be removed prior to reuse for recreational purposes. The existence of fences was not considered in the risk assessment.

Comment 171: **<u>Page 7-96, Section 7.5.2</u>. The hierarchy for selecting sediment ecological screening values (ESVs) is presented in the section. National Oceanic and Atmospheric Administration (NOAA) screening quick reference tables (SQRTs) chronic freshwater ambient water quality criteria is incorrectly listed as the secondary sediment ESV. The NOAA SQRTs freshwater sediment threshold effects level (TEL) should be listed as the secondary source. Please address.**

Response 171: Agree. The second bullet item under the hierarchy for selecting sediment ESVs will be revised to NOAA SQRT threshold effect levels (TELs).

Final Response: This comment is unresolved.

Comment 172: **<u>Page 8-6, Section 8.4.</u> The portion of Range 20 within the security fences was not investigated. Therefore, additional investigation is needed to adequately characterize this range prior to conducting the risk assessment. Range 20 is not suitable for release without restriction or further investigation. Please revise this section accordingly.**

Response 172: See response to General Comment 14.

<u>ADEM Evaluation of Response</u>
Please see evaluation of response to General Comment 14.

Final Response: This comment is unresolved.

Comment 173: **<u>Page 8-7, Section 8.6.</u> Please clarify in the document that further investigation of soil and groundwater is warranted for Range 20.**

Response 173: See response to General Comment 14.

<u>ADEM Evaluation of Response</u>
Please see evaluation of response to General Comment 14.

Final Response: This comment is unresolved.

Comment 174: **<u>Page 8-7, Section 8.6.</u> The nature and extent of contamination at the BBGR Ranges has not been defined. The recommendation that no further investigation is warranted to define the nature and extent of contamination at the BBGR Ranges should be removed from the document. Please address.**

Response 174: See response to General Comment 3.

<u>ADEM Evaluation of Response</u>
Please see evaluation of response to General Comment 3.

Final Response: This comment is unresolved.

Comment 175: **<u>Table 2-3.</u> The values of turbidity for well HR-79Q-MW02 of greater than 1000 nephelometric turbidity unit (NTU) is beyond normal expectations, as well as dissolved oxygen at levels below 1 mg/L. Please clarify in the document the cause and effects of these anomalous values.**

Response 175: Agree. It should be noted that due to the very fine-grained sands and silts present in the residuum, some monitoring wells have naturally high turbidity readings even after prolonged periods of development. The cause of the low DO readings is unknown. It is worth noting that the DO readings initially taken during purging were normal but decreased throughout the purging process. This information will be added to Section 2.2.4.

Final Response: This comment is unresolved.

Comment 176: **<u>Table 2-4.</u> The groundwater elevation for well HR-83Q-MW02 is higher than the ground elevation and is above the screen interval. Please clarify**

if the groundwater is under confined conditions. Please discuss the limitations from the well screen placement and suggest corrective action.

Response 176: Yes, the upward hydraulic gradient supports general confined aquifer conditions as noted in the RI report (Section 3.8.2 lines 11 through 14). During the drilling of monitoring well HR-83Q-MW02, groundwater was encountered at a depth of 17 feet bgs (see boring log in Appendix B). A 15-foot length of well screen was then appropriately set at 9 to 24 feet bgs based on the groundwater depth encountered. During subsequent sampling, the groundwater sample was collected at a depth of approximately 14 to 20 feet bgs, which was within the screened interval. Thus, there are no "limitations from the well screen placement" and no corrective action is required.

Comment 177: **Table 4-1 and 4-5. Please provide the Laboratory Quantitation Limit for all not detected (ND) values.**

Response 177: These values are included in Appendix G – Summary of Validated Analytical Data as "U"-flagged data.

ADEM Evaluation of Response

Please note that a tabulation of U values is preferable to non-detects (NDs).

Final Response: This comment is unresolved.

Comment 178: **Table 4-1 and 4-2. Soil results for HR-118Q-GP12, GP-13, GP-14, GP-15, and GP-16 do not appear in these tables. Please update these tables.**

Response 178: Agree. Surface soil samples were collected at locations HR-118Q-GP12, GP-13, GP14, GP15, and GP16. These data will be added to Table 4-1. In addition, the sample location map (Figure 2-7) will be revised to show these locations as surface soil samples only.

Final Response: This comment is unresolved.

Comment 179: **Figure 1-1. Please include in the drawing the artillery impact area referred to on Page 2-5.**

Response 179: Comment noted. Figure 1-1 will be revised to show the WWI Artillery Impact Area.

Final Response: This comment is unresolved.

Comment 180: **Figure 1-12. Please clarify what is meant by "target mounds". The topographic contours do not appear to show these locations as "mounds". Please clarify what is actually stopping the bullet flights at these ranges.**

Response 180: As noted in the RI report in Chapter 1.0, each firing lane has a series of six "mounds" with pop-up targets as shown on Figure 1-12. These mounds are

man-made earthen features measuring approximately 3 feet high by 6-8 feet in circumference. The six target mounds are grouped together at located of 50, 100, 150, 200, 250 and 300 meters from each of the 16 firing points (a total of 96 mounds). The "pop-up targets" at each mound would receive the majority of the bullets with some bullets striking the main impact area located directly beyond the 300-meter target mounds as shown on Figures 1-12 and 4-1.

ADEM Evaluation of Response
Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 181: **Figure 2-1 through 2-10. Please provide the known or inferred direction of groundwater flow on these figures. Also, please note the basis for determining the groundwater flow directions in notation on the figures.**

Response 181: Groundwater flow direction is shown on Figure 3-7. Groundwater contours and flow directions were determined based on the water level measurements taken in December 2002, as noted on the figure.

ADEM Evaluation of Response
Please overlay the groundwater flow direction arrows on Figures 2-1 through 2-10.

Final Response: This comment is unresolved.

Comment 182: **Figure 2-7. Please explain the red triangle symbol on the map in the legend.**

Response 182: Agree. The figure will be revised to indicate that the red triangle symbolizes an XRF sample location.

Final Response: This comment is unresolved.

Comment 183: **Figure 2-10. Please indicate on the figure the depth of the XRF samples.**

Response 183: Comment noted. XRF samples were collected at a depth of 0-3 inches. This information will be added to the figure.

Final Response: This comment is unresolved.

Comment 184: **Figure 3-4. The geologic cross section A-A' presented does not appear to accurately represent the geologic and well construction information presented in the boring logs for HR-118Q-MW01 and MW02. Please revise accordingly.**

Response 184: Disagree. The boring logs for HR-118Q-MW01 and HR-118Q-MW02 indicate that clay with "shaley texture" was encountered at approximately 25 feet below ground surface (bgs). The top of limestone bedrock was

encountered at approximately 37 feet bgs indicating the weathered shale or clay is approximately 12 feet thick as presented on Figure 3-4. It should be noted that shale will weather to a clay residuum.

Comment 185: **<u>Figure 4-3.</u> It is unclear how the contour intervals were selected for the color contouring. The intervals should have corresponded to regulatory thresholds such as residential and industrial/commercial criteria. Please revise accordingly.**

Response 185: The contour intervals on Figure 4-3 already include the residential SSSL (400 mg/kg) and industrial SSSL (880 mg/kg) for lead. Including a contour interval for the recreational site user SSSL (7,600 mg/kg) is unnecessary because the highest detected lead concentration in subsurface soil was less than 7,600 mg/kg. The figure will be revised to show the following two lead contour intervals: "400 – 879" and "880 – 7,599".

Final Response: This comment is unresolved.

Comment 186: **<u>Figure 4-3.</u> Please include the XRF data on this figure.**

Response 186: Disagree. As shown in Table 4-6, all XRF lead results for subsurface soil (i.e., >1 foot bgs) were less than 70 mg/kg, which is lower than the lowest contour interval on the figure.

Comment 187: **<u>Figure 4-3.</u> Please develop a map showing all soils contaminated by one or more constituents above regulatory criteria and background levels.**

Response 187: The other metals COPCs were almost exclusively co-located with the elevated lead results. The text will be revised for clarification. Additional figures for the other metal COPCs are not necessary.

Final Response: This comment is unresolved.

Comment 188: **<u>Figure 4-3.</u> The contamination at each range is site-specific and each range should have separate data plots. The contamination data needs to be tied to distinct areas of the site such as background, firing points, target areas, and backstops. The data should be shown in plan view and cross-section with annotated points of interest. Since the data is sparse for each range, the extent of contamination should be conceptually portrayed. These types of firing ranges have very predictable contamination impacts and these conceptual model aspects need to be included in the extent of contamination assessment. Please address.**

Response 188: Comment noted. It is unclear how separate data plots for each range will provide any further useful information or understanding of the contamination at the BGR Ranges. Therefore, the Army feels that it is not worth the time and expense to do so. However, the isocontour maps will be revised to show

distinct areas of the sites such as firing lines and target lines/impact areas per the reviewer's request.

Final Response: This comment is unresolved.

Comment 189: **<u>Appendix G.</u> Please verify the results reported for nitroaromatic compounds in soil and sediment samples. The results do not appear to be corrected for the percent solids of each sample, as was done for the other parameters. Please clarify if these results were indeed corrected.**

Response 189: The results reported in Appendix G for nitroaromatic compounds in soil and sediment samples were not "corrected" for moisture per EPA Method SW-846 8330 Nitroaromatics and Nitramines by High Performance Liquid Chromatography (HPLC). Instead, the samples were air dried at room temperature (or cooler) to a constant weight prior to extraction.

Comment 190: **<u>Appendix G.</u> Please clarify why the summary tables still list the original results as reported by the laboratory when some of the data were rejected during data validation (qualified "R"). Please provide clarification that the original results as reported by the laboratory will not be used for project objectives.**

Response 190: The analytical data summary presented in Appendix G includes all the data as reported by the laboratory and data validation qualifiers that are applied during review.

No "R"-flagged data are included in the RI report discussion or used in risk assessment.

Comment 191: **<u>Appendix G, Section 2.2.</u> The document refers to the reporting of the target compound list (TCL) volatile organic compounds (VOCs). However, the TCL VOC list was not utilized for any of the matrices (soil, sediment, surface water, and groundwater). The list reported contained many compounds not on the TCL. In addition, 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113), methyl acetate, methyl tertiary butyl ether, cyclohexane, and methylcyclohexane are on the TCL but were not reported. Please clarify if the lack of results for selected TCL VOCs will adversely affect the project objectives.**

Response 191: The "TCL" for Fort McClellan was established in the project SAP and QAPP. These TCLs are a project-specific list of compounds that have been submitted and approved for all investigations conducted to date at Fort McClellan by IT/Shaw for the Army. The few compounds listed in the comment have no bearing on the data usability or objectives of the RI.

Comment 192: **<u>Appendix H.</u> Many VOC results were rejected due to response factors less than 0.1 in the initial and continuing calibrations. The validation guidelines require the rejection of data only when the response factors**

are below 0.05. Please clarify why a more conservative approach was taken for the validation since the method utilized (SW-846 8260B) requires a minimum response factor of 0.1 for only three compounds. The use of 0.05 as a cutoff for rejection may have resulted in less data being rejected. Also, please provide justification in the document as to why 0.1 was used as a cutoff for rejection of sample data.

Response 192: The 0.1 RRF QC criterion was applied for VOC data review because EPA SW-846 Method 8260B (i.e., a performance-based method) was used for the analytical method and not the CLP OLM volatile method, which uses the 0.05 RRF QC limit. The CLP National Functional Guidelines also have the 0.05 QC limit. Since there are no published EPA guidelines on how to validate SW-846 data, data validation was performed in accordance with the logic identified in the National Functional Guidelines and the SW846 QC limit was used. It should be noted that using a 0.1 RRF QC criteria is a more conservative approach.

Comment 193: **<u>Appendix H.</u> Please clarify why EPA Region III data validation guidelines were used only for the qualification of samples due to blank contaminants. Also, please clarify why the EPA National Functional guidelines which were used to evaluate other aspects of the data were not used for blank contamination. The final Field Sampling Plans for these investigations noted that only the EPA National Functional guidelines would be used for validation.**

Response 193: It should be noted that EPA SW-846 methods were used to analyze the samples collected at the BBGR Ranges. SW-846 methods do not have specifically designated data validation procedures. Therefore, it has been Shaw's standard practice since 1998 on the Fort McClellan project to use the EPA Region III Modification of the National Functional Guidelines (NFG) to handle blank contamination. This is referenced in all Shaw-issued data validation reports.

The EPA Region III procedure specifies that blank contamination will be identified using a "B" data flag instead of the customary "U" qualifier as dictated by the CLP NFGs. It should be noted that the actions for qualification due to blank contamination are basically the same between the two NFGs, the only difference is the actual qualifier that is appended to the data. This practice has proven to be of benefit to the project chemist, report writers, and risk assessment staff when evaluating FTMC data.

Comment 194: **<u>Appendix H.</u> If the EPA Region IV or EPA National Functional data validation guidelines had been applied, the detection of arsenic in the Range 20 surface water sample and the detection of beryllium in one Range 18 surface water sample would not warrant discussion in Section 4.0 due to SSSL, ESV, and/or background exceedances as these results would have been qualified as nondetects. Please address.**

Response 194: Comment noted. However, for consistency's sake, the BBGR RI data were evaluated and reported using the same approach and methods as the other several hundred reports that have been prepared by Shaw for the BRAC project at FTMC over the last 9 years.

Comment 195: **<u>Appendix H.</u> The EPA Region IV data validation guidelines require that pesticide results with dual column percent differences greater than 70% be qualified as nondetects. There were many instances of pesticide results with relative percent differences greater than 70 and in many of these instances, the detected results were below the quantitation limits. Many of these particular pesticide results are also discussed in Section 4.0 as SSSL, ESV, and/or background exceedances. Although the EPA National Functional guidelines provide no guidance on this issue, the EPA Region IV data validation guidelines are consistent with other validation approaches and should also be used to evaluate these results. This would allow the data user to have a more accurate perception of the actual exceedances which exist. Results which have high percent differences and are below the quantitation limit are highly suspect due to the nature of the gas chromatography analyses and therefore should be qualified as discussed in these EPA Region IV guidelines. This qualification scheme would be applied to all analyses which utilize dual column analyses and would provide a more accurate depiction of analytes present in the samples. This would eliminate many exceedances of pesticides in surface soil at Range 18, 23, 25 and 26, 2-(2-methyl-4-chlorophenoxy) propionic acid (MCPP) in surface soils at Range 23, beta-BHC in one groundwater sample in Range 25, and MCPP in one sediment sample at Range 20. Please address.**

Response 195: See previous response.

<u>ADEM Evaluation of Response</u>
Response is adequate and noted. Please note that it is understood that consistency with past reports is desired but it may be appropriate to reevaluate the procedures used for validation in the future to be more consistent with current guidelines.

Comment 196: **<u>Appendix I.</u> Please provide supporting descriptive statistics and goodness-of-fit tests even though boxplots were included in this analysis. As is, a number of assumptions as to the quality of the data along with the relevance of the statistical tests selected is required. Please provide this data at the beginning of the results section in this Appendix.**

Response 196: Distribution testing was performed on the background data and appropriate background screening values were calculated, in accordance with EPA guidance. The background screening values consist of 95th UTLs for lognormally and normally distributed analytes, and 95th percentiles for nonparametric distributions. This information is provided in the approved installation-wide work plan, which was issued in February 2002 (IT

Corporation, 2002). A reference to this document will be added to the statistical evaluation section (Tiers 1 and 2) of Appendix I.

Final Response: This comment is unresolved.

Comment 197: **<u>Appendix I.</u> Please clarify in the document whether a single detection limit was involved for a single compound or if multiple detection limits are present.**

Response 197: Multiple detection limits are present for many elements in the site and background data sets. Please note that the Wilcoxon rank sum test is the approved two-sample test for Fort McClellan site-to-background comparisons. This is documented in the approved installation-wide work plan (IT Corporation, 2002), technical memoranda (e.g., Shaw Environmental, Inc., 2005), and BCT meeting minutes. The combination of the WRS test and background threshold comparison, followed by geochemical evaluation for any element that fails either of these two tests, has been demonstrated to be a highly effective method for distinguishing site-related contamination from naturally high concentrations at many Fort McClellan sites, and it has also been successfully applied at many other facilities.

It is also important to note that for the Fort McClellan site-to-background comparisons, the WRS test is only performed when the site and background data sets both contain less than 50 percent nondetects. This is because the WRS test compares the medians of the two distributions, and the true median cannot be determined when the nondetect frequency is 50 percent or higher. This approach minimizes the impact of nondetects and multiple reporting limits on the test results.

Comment 198: **<u>Appendix I.</u> A statistically significant α probability (*p*) level is always reported where $p<0.05$, not 0.20. This is the standard cutoff in all statistical analyses. Please revise document appropriately.**

Response 198: The Army agrees that a significance level of 0.05 is conventionally used for most statistical site-to-background comparison tests. Please note that for the WRS tests performed for the Fort McClellan project, the significance level has been set to 0.20 at the request of EPA Region 4. This cannot be modified without EPA's consent.

<u>ADEM Evaluation of Response</u>

Setting the alpha probability cutoff at 0.2 has resulted in a greater number of significant differences (some of which may not be real), which is a very conservative approach. In the revised report please clarify whether the EPA Region 4 has a specific reason for setting the probability cutoff so high.

Final Response: This comment is unresolved.

Comment 199: **<u>Appendix I.</u> The statistical analysis section should not be abstracted from the soil sample collection methodology and results. Please include a summary of all sample collection methods, along with a figure depicting all sample locations in Appendix I.**

Response 199: The soil sample collection methodology, analytical results, and sample location map are provided within the body of the RI report. A sentence noting the location of this information will be added to Section 1.0 of Appendix I. The complete RI report consists of four volumes in four discrete binders; the wording of the comment suggests that perhaps Appendix I was separated from the rest of the report during the review process.

Final Response: This comment is unresolved.

Comment 200: **<u>Appendix I.</u> Please identify the statistical package used to conduct the statistical analysis.**

Response 200: StatSoft© STATISTICA software was used to prepare the box plots and perform the WRS tests.

Comment 201: **<u>Appendix I, Page 2, Section 2.1.2. (Slippage Test).</u> Please discuss in this section that the maximum value selected for each compound from the background data set was confirmed as belonging to the underlying population with an outlier analysis. Before conducting the outlier test, the distribution type of data, e.g., normal, lognormal, weibull, gamma etc., needs to be determined. Please clarify that the site and background sample sizes are sufficient for the slippage test to have adequate power (0.8 or 0.9) to declare a compound a COPC when it is actually true. Please also identify the proportion (ε) of the site with concentrations greater than the background even though the absolute number of hits above background is provided in Tables 1-5.**

Response 201: Please note that the Slippage test is no longer a component of Fort McClellan site-to-background comparisons, per the agreement reached during the BRAC Cleanup Team (BCT) meeting on January 25, 2005. The Slippage test has been replaced with another test of upper tails, consisting of comparison of site data to background screening values (95th upper tolerance limit for analytes with normal or lognormal distributions in the background data set; and the 95th percentile for analytes with neither normal nor lognormal distributions and/or that have greater than 15 percent nondetects in the background data set). The Baby Bains Gap Road Ranges RI report was published in August 2004, which predates this change in the site-to-background comparison methodology. The revised methodology is described in the technical memorandum entitled "Selecting Site-Related Chemicals for Human Health and Ecological Risk Assessments, Revision 3" (Shaw Environmental, Inc., 2005), which will be included in Appendix I of the revised RI report.

The background study is presented in the *Final Background Metals Survey Report, Fort McClellan, Anniston, Alabama* (SAIC, July 1998), which has been approved by the BCT. This document describes the methodology for collection, analysis, and evaluation of the background data.

Final Response: This comment is unresolved.

Comment 202: **<u>Appendix I, Page 2, Section 2.1.2. (Wilcoxon Rank Sum Test).</u> It is unclear whether contamination is distributed in discrete patches or uniformly across the site. Please address.**

Response 202: The WRS test is performed in conjunction with a background threshold comparison, as described above in the Response to Specific Comment 201. This test is a test of upper tails that identifies potential hot spots. The combination of the WRS test and the background threshold comparison permits both modes of contamination to be identified.

Please note that the background threshold comparison is a far more conservative test than the Slippage test – in other words, it has a higher false-positive error rate – which is why it has replaced the Slippage test in Fort McClellan site-to-background comparisons. The revised site-to-background comparison methodology (comprised of the WRS test and background threshold comparison) has already been applied at many Fort McClellan sites. The Slippage test will be deleted from the Baby Bains Gap Road Ranges site-to-background comparison, and Appendix I will be revised accordingly.

Final Response: This comment is unresolved.

Comment 203: **<u>Appendix I, Page 3, Section 2.1.2. (Wilcoxon Rank Sum Test).</u> Please clarify whether contamination is distributed in discrete patches or uniformly across the site. Please confirm that all less-than Method Detection Limit (MDL) values analyzed with the WRS test are in fact similar and that the detection limit is smaller than the smallest detected measurement. Please confirm that *n* (number of data points in larger group) and *m* (number of data points in smaller group) are of a sufficient size to achieve the desired power. The text states in Paragraph 2 of Page 3 that "if ties occur between or within samples, each one is assigned the mid-rank." This procedure may be appropriate with small numbers of ties. However, in instances where a large number of ties are encountered, a corrected version of Z (test statistic) should be calculated. Please address. Also, please identify whether it was necessary to modify the WRS calculation to reflect sample size.**

Response 203: Regarding the mode of contamination, please see the response to Specific Comment 202.

Nondetects are set to one-half the quantitation limit (not one-half the MDL) for the Fort McClellan WRS tests. Multiple detection limits are present in the

site and background data sets and detection limits are not available for all of the background samples, so it cannot be determined if the detection limits are smaller than the smallest detected measurement. Please also see the Response to Specific Comment 197 regarding multiple reporting limits.

The power of the WRS test is not determined for Fort McClellan investigations, and it is not clear what would be gained by such retrospective analyses. The site sample sizes were determined several years ago, when the various site-specific work plans were approved by the BCT. Likewise, the background data sets were approved several years ago (SAIC, 1998), and thus the background sample sizes are also fixed.

Regarding tied values, the WRS test is performed using STATISTICA software, which automatically provides adjusted *Z* scores.

Please note that the approved Fort McClellan site-to-background comparison methodology – which consists of the WRS test and a background threshold comparison (Tier 2), followed by geochemical evaluation (Tier 3) for any element that fails either of these two tests – has been demonstrated to be a highly effective method for distinguishing site-related contamination from naturally high concentrations at many Fort McClellan sites.

Comment 204: **<u>Appendix I, Page 4, Section 2.1.2. (Boxplots).</u> Please label the boxplots provided in Attachment 1 with the following: median, minimum, maximum, 25th quartile, and 75th quartile.**

Response 204: A figure containing an example box plot will be added to Appendix I (in the "Box Plots" subsection). It will identify all of the components listed in the comment.

Final Response: This comment is unresolved.

Comment 205: **<u>Appendix I, Page 4, Section 2.1.2. (Hot Measurement Test).</u> Normality or lognormality of the data sets compared with this method is an underlying assumption. Please identify the distribution type of each data set for which a 95% upper tolerance limit (UTL) or 95% upper confidence limit (UCL) was calculated with an applicable goodness-of-fit test. If the data sets follow another distribution type, please calculate the appropriate UTL/UCL.**

Response 205: Distribution testing was performed on the background data and appropriate background screening values were calculated, in accordance with EPA guidance. The background screening values consist of 95th UTLs for lognormally and normally distributed analytes, and 95th percentiles for nonparametric distributions. This information is provided in the approved installation-wide work plan, which was issued in February 2002 (IT Corporation, 2002). A reference to this document will be added to the statistical evaluation section (Tiers 1 and 2) of Appendix I.

Final Response: This comment is unresolved.

Comment 206: **<u>Appendix I, Page 8, Section 3.1 (Surface Soil), Chromium.</u> Chromium is the only median that is of interest in the summary of the boxplot results. The median of the background and the contaminated site should always be discussed in the boxplot section. Please address.**

Response 206: The text will be revised to compare the medians of the site and background data sets.

Final Response: This comment is unresolved.

Comment 207: **<u>Appendix I, Page 18, Section 3.3 (Sediment), Antimony.</u> Please clarify if the WRS section indicated that there was only a single detected value.**

Response 207: The text will be clarified, as requested.

Final Response: This comment is unresolved.

Comment 208: **<u>Appendix I, Geochemical.</u> Please include in this section ambient soil and sediment physicochemical properties reported in the background and the contaminated site. Soil chemical properties should include pH, TOC, etc., while physical properties could include grain size distribution, etc.**

Response 208: All available soil and sediment data are considered during the geochemical evaluations. Please note that the geochemical evaluations have been discussed during Fort McClellan BCT meetings over the past several years, and they have also been discussed in responses-to-comments on previous Fort McClellan reports. The BCT has accepted the geochemical evaluations, in their current form, for use as one line of evidence when determining whether metals concentrations are site-related or most likely natural.

Comment 209: **<u>Appendix I, Geochemical.</u> Please demonstrate that the surface/subsurface soil sample plan was such that the soil series was effectively characterized.**

Response 209: The topic of soil types has already been discussed and resolved during several Fort McClellan BCT meetings and conference calls. The key aspect of geochemical evaluations is the comparison of elemental ratios in site samples versus background samples. Characterization of soil types is not relevant to the geochemical evaluations, because the elemental ratios are consistent across the facility and are not influenced by soil type.

Please note that the geochemical evaluations have been discussed during the BCT meetings over the past several years, and they have also been discussed in responses-to-comments on previous Fort McClellan reports. The BCT has accepted the geochemical evaluations, in their current form, for use as one line

of evidence when determining whether metals concentrations are site-related or most likely natural.

Please also note that the background study is presented in the *Final Background Metals Survey Report, Fort McClellan, Anniston, Alabama* (SAIC, July 1998), which has been approved by the BCT. This document describes the methodology for collection, analysis, and evaluation of the background data.

Comment 210: **<u>Appendix I, Geochemical.</u> Please include a scatter plot exhibiting a trend line, R^2 value, slope formula, and a corresponding ρ-value, where statistically significant results are reported where $\rho \leq 0.05$.**

Response 210: References to linearity in the geochemical correlation-plot discussions imply a linear relationship between element concentrations, which is not appropriate (except in rare instances), and such references will be deleted. The second sentence in the second full paragraph on page 3 will be deleted, and the third sentence will be revised to state that "If the samples with the highest arsenic concentrations plot on the same trend as the other samples (exhibit similar As/Fe ratios), then it is most probable that the elevated concentrations are natural, and are caused by the preferential enrichment of iron oxides in those samples." Key to the geochemical evaluation is the comparison of site elemental ratios versus background elemental ratios.

The value of the geochemical evaluation is that it provides geochemical explanations for elevated metals concentrations. Statistical site-to-background comparison tests (Tiers 1 and 2) can only indicate whether or not site metals concentrations are shifted higher relative to background concentrations. The geochemical evaluation (Tier 3) can help us elucidate <u>why</u> the site concentrations are higher.

There are many reasons why quantitative techniques should be avoided when performing geochemical evaluations. These reasons have been discussed during BCT meetings over the past several years, and they have also been provided in responses-to-comments on previous Fort McClellan reports. As discussed at these meetings and in the responses-to-comments, statistical (quantitative) data evaluations are performed only during the Tier 1 and Tier 2 site-to-background comparisons. The BCT has accepted the geochemical evaluations, in their current form, for use as one line of evidence when determining whether metals concentrations are site-related or most likely natural.

For the benefit of the report reviewers, a summary of these previous discussions is provided in the following paragraphs.

A number of standard statistical parameters can be used to quantify the degree of correlation between two parameters, including the coefficient of determination (R^2), standard error of the slope, and significance of the slope. In addition, different types

of error bands surrounding the fitted line can be constructed based on the uncertainty of the slope and intercept, confidence intervals, or prediction intervals. One could establish a rule such as "samples that plot above a ± 2-sigma error band (or above a 95th confidence or prediction interval) about the regressed line are considered contaminated," but such a rule is not justified for different metals that exhibit natural differences in linearity, or for data sets that contain nondetect or estimated results. A 1-sigma or 2.5-sigma rule would yield different results. There is no technical basis for establishing these arbitrary pass-fail criteria. One could also perform many different kinds of regressions based on generalized linear models, and each could potentially yield different results. There are several additional reasons why quantitative techniques should be avoided for outlier identification:

1 - Each element has varying degrees of correlation with the major element(s) with which it is associated. Some elements have very strong affinities for a particular type of mineral whereas other elements will partition themselves between several minerals. For instance, vanadium has a particularly strong affinity for iron oxides, so R^2 values for V vs. Fe are usually very high, significance of the slope is high, and confidence intervals are narrow. Correlations of As vs. Fe are also high at most sites, but not as high as V vs. Fe. In contrast, Cr will form several co-existing aqueous species [$Cr(OH)_2^+$, $Cr(OH)_3^o$, $Cr(OH)_4^-$] which will adsorb on several different types of minerals including iron oxides and clays. This will yield a lower R^2 for Cr vs. Fe or Cr vs. Al relative to the R^2 values observed for V vs. Fe. Correlations of Ag, Hg, and Tl versus any major element are usually not very strong (although Hg is often correlated with total organic carbon). Some elements are obviously more selective than others with respect to adsorption on specific mineral surfaces, and this selectivity is further modified by local site conditions, (especially pH, redox, and concentrations of competing species). We have observed these trends on many projects where these techniques were applied. Any pass-fail criterion would need to be specific for each element, and varied for each site.

2 – The elemental associations and degree of correlation in soils are dependent on soil mineralogy, and are hence site-specific. We have performed many site-to-background comparisons for TAL elements in soils for sites such as Fort McClellan and Redstone Arsenal, Alabama, and soils at some of these sites have a very high proportion of manganese oxides. Where these Mn-oxides are present at high concentrations, we see very strong correlations between Ba, Cd, Co, Ni, and Pb versus manganese. However, in low-Mn soils where discrete Mn-oxides are not present, these elements apportion themselves on clays and/or iron oxides instead. Different reference elements need to be used at different sites, and these different reference elements will yield different degrees of correlation with trace elements.

3 - The R^2 values, confidence limits, and prediction limits are highly influenced in a non-linear manner by outliers. One sample that is far off of the trend will lower the R^2 and widen the confidence limits to a much greater extent than several samples that are slightly off of the trend. The removal of a single point that is far from the regression line can greatly increase the R^2 and tighten the confidence intervals, even in a large data set.

4 – Some elements have concentrations that are well above the detection limits, whereas other elements contain many estimated (J-qualified) concentrations that are more uncertain. Higher uncertainty in estimated data will yield more scatter in the plots, wider prediction intervals, and lower R^2 values. These analytical uncertainties will

affect the confidence and prediction limits in unique ways for each element. This effect can be seen in many correlation plots where there is more scatter in the data points at the lower concentration ranges, which is due to greater analytical uncertainty as well as laboratory reporting to fewer significant figures at lower concentrations that are near the reporting limit.

5 – Only detected concentrations can be included in the correlation plots because surrogate values such as ½ the reporting limit are an artifact of the analysis and will cause errors in the correlation parameters. If an element has a high percentages of nondetects, then only a partial segment of the actual trend can be quantified, resulting in lower confidence in any statistical fit parameters. Statistical parameters describing a curve that is limited to the upper range of values does not capture the true correlation. As an example, Ag and Tl usually have high percentages of nondetect results, so detectable concentrations often have a narrow range of less than an order of magnitude. As a consequence, the correlations between these elements and major elements are usually poor, and error bands are wide. This is because there are many different ways to pass a line through points that are close together, but points that are spread over a broad range will tend to anchor regression lines and create error bands with limited degrees of freedom. In other words, the percentage of nondetects, which is a function of a laboratory process rather than a natural process, has an undue influence on the apparent degree of correlation that is observed.

6 – Evaluation of a set of geochemical data is not always a simple two-dimensional problem. All relevant data are examined before a conclusion is reached. Where groundwater and surface water are concerned, metals data for samples from reducing waters often exhibit far more scatter (lower R^2 values) in elemental correlation plots compared to data for samples from oxidizing waters. Such behavior is expected for the redox-sensitive elements (e.g., iron, manganese, and arsenic). The reducing conditions may be induced by site-related contamination or they may be natural. The reason for the weak correlation must be determined via geochemical evaluation, by considering all relevant data including redox indicators, pH, anion concentrations, organic contaminant concentrations, etc. – rather than relying on arbitrary pass-fail criteria such as a difference in R^2 values or positions with respect to prediction limits between the site and background data sets. Even in soils, different relationships can exist in different samples. For instance, lead in soil developed on weathered limestone will usually be correlated with aluminum because the lead released from the limestone during the weathering process adsorbs on aluminum-bearing clay minerals. The result of this process is a positive correlation between lead and aluminum concentrations. However, samples containing unweathered clasts of limestone can exhibit a correlation between lead versus calcium instead of lead versus aluminum. This complexity cannot be captured by the use of confidence or prediction limits.

ADEM Evaluation of Response

Response noted. Please include the response in the revised text.

Final Response: This comment is unresolved.

Comment 211: **<u>Appendix I, Geochemical.</u> Some of the scatter plots indicate the presence of possible outliers. The outliers should be tested before conducting this type of analysis. Please address.**

Response 211: It appears this comment is referring to the background samples. A similar comment was received on the Bains Gap Road Ranges RI report, in reference to an apparent outlier for barium in the background soil data set (in the plot of barium versus manganese). In the case of barium, the background sample with the highest barium concentration also has the highest manganese concentration. Its Ba/Mn ratio (0.24) is consistent with those of the other background samples and is below the mean background Ba/Mn ratio (0.31). This indicates that the barium in the sample is most likely natural and should be considered representative of background. As discussed on page 1 of the geochemical evaluation (Tier 3) report, "Trace element distributions in uncontaminated soil tend to have very large ranges (two to three orders of magnitude are not uncommon), and are highly right-skewed, resembling lognormal distributions." It is expected that the Fort McClellan background data set, which contains 122 samples collected over thousands of acres, would include a very high barium concentration.

It should be noted that the background study is presented in the *Final Background Metals Survey Report, Fort McClellan, Anniston, Alabama* (SAIC, July 1998), which has been approved by the BCT. This document describes the methodology for collection, analysis, and evaluation of the background data. We do not think it is appropriate to re-screen the background data at this stage in the site investigation and remediation process.

Comment 212: **<u>Appendix I, Geochemical.</u> Please include separate scatter plots constructed for background and site samples.**

Response 212: The background samples are depicted on the same plots as the site samples for comparative purposes. Key to the geochemical evaluation is the comparison of site elemental ratios versus background elemental ratios. Without background samples for comparison, confidence in the determination of presence or absence of contamination is decreased.

Please note that the geochemical evaluations have been discussed during Fort McClellan BCT meetings over the past several years, and they have also been discussed in responses-to-comments on previous Fort McClellan reports. The BCT has accepted the geochemical evaluations, in their current form, for use as one line of evidence when determining whether metals concentrations are site-related or most likely natural.

References Cited in Responses 196 - 212:

IT Corporation, 2002, ***Draft Installation-Wide Work Plan, Fort McClellan, Calhoun County, Alabama, Revision 2***, Prepared for the U.S. Army Corps of Engineers, Mobile District, February.

Science Applications International Corporation, 1998, ***Final Background Metals Survey Report, Fort McClellan, Anniston, Alabama***, July.

Shaw Environmental, Inc., 2005, "Selecting Site-Related Chemicals for Human Health and Ecological Risk Assessments, Revision 3," Memorandum from K. Thorbjornsen, J. Myers, and P. Goetchius to the Ft. McClellan Project File, March 14.