APPENDIX H

PRELIMINARY HUMAN HEALTH RISK ASSESSMENT

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Memorandum

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To: Preliminary Risk Assessment (PRA) File

From: Paul F. Goetchius, DVM
Senior Toxicologist, Risk Management Services

RE: Former Rifle/Machine Gun Range (Parcel 104Q), Fort McClellan, Calhoun County, Alabama
Preliminary Risk Assessment File

PRELIMINARY RISK ASSESSMENT FOR SUBJECT SITE: REVISION 1

This memorandum provides a Preliminary Risk Assessment (PRA) for the Former Rifle/Machine Gun Range, Parcel 104Q, hereinafter referred to as the area of investigation. Parcel 104Q is a slender rectangular plot (approximately 254 feet [ft] by 2,094 ft) approximately 8 acres in size located in the north-central area of the Main Post of Fort McClellan (FTMC), as shown on Figure 1-1 from the Site Investigation Report (SI). Details of the layout, firing line, berms, bunkers and sampling locations are shown on Figure 3-1 from the SI.

Data regarding the dates of operation and types of ordnance used are unavailable. Existing records, however, indicate that the area of investigation was used as a machine gun range during World War I, and was abandoned prior to World War II.

The purpose of the PRA is to evaluate the analytical results of surface soil, subsurface soil and groundwater sampling to support a conclusion of no further action and unrestricted site use with regard to CERCLA-related hazardous substances proposed by the SI. The PRA is a shortened version of the Streamlined Risk Assessment (SRA) protocol developed as a uniform and economical approach to evaluating hundreds of similar sites at FTMC. It is assumed that the reader is familiar with FTMC and the fundamentals of the SRA. The reader is referred to the Installation-Wide Work Plan (IT, 2002) for more detail. All the comparison and computational operations of the PRA are performed within EXCEL® spread sheet tables. The results of each step are described below.

The first version of the PRA was prepared in November 2002. The November 2002 version determined that many of the metals in surface soil and total soil were site-related; i.e., their concentrations appeared to exceed background concentrations. Subsequent to that exercise, however, the protocol for FTMC for comparing background and site data sets and for selecting site-related chemicals has changed, making better use of background and site data, applying

more precise statistical comparisons, and employing geochemical analysis to help resolve the site-related question as necessary (Shaw, 2003). The refinement in the procedure for selecting site-related chemicals was the main reason for this (first) revision of the PRA.

Also, instead of evaluating exposure to surface and subsurface soil as separate media, surface and subsurface soil data were combined to form a data set called "total soil," to cover for the likelihood that site development for any use would involve excavation and grading that could bring subsurface soil to the surface. The maximum detected concentration (MDC) listed in the total soil tables is the highest concentration detected in either surface or subsurface soil. Therefore, the total soil evaluation also conservatively accounts for all scenarios in which the receptor might be exposed to either surface soil or subsurface soil alone. This revision simplifies the PRA without any sacrifice in precision or protectiveness.

Media of Interest and Data Selection. Media of interest on the area of investigation include surface soil, subsurface soil, and groundwater. Surface soil samples were taken from 0 to 1 ft below ground surface (bgs). Subsurface soil samples were taken from1 to 4 ft bgs. No surface water bodies are associated with the area of investigation. The 22 surface soil and co-located subsurface soil samples were taken along the entire length of the former range, but were generally placed near the berms (target lines) or bunkers that may have received the majority of the weapon fire (Figure 3-1 from the SI). Two sample locations were placed on the uphill slope approximately 200 and 300 ft downrange of the former range to evaluate the potential for contamination from stray weapon fire. The two groundwater samples were taken from two monitoring wells; one located at the first berm and the other located near the fourth berm from the firing line. All samples were analyzed for target analyte list (TAL) metals and nitroaromatic/nitramine explosives. Approximately 10 percent of the samples were analyzed also for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), organochlorine pesticides, and the chlorinated herbicides.

It appears that a sufficient number of samples of all relevant media were appropriately taken from strategically determined sampling locations, and that the samples were analyzed for a sufficiently wide spectrum of parameters so that the data are judged to be sufficient for risk characterization. The proposed sampling locations and analytical parameters were originally presented to the BCT at the February 2002 project team meeting. Except for adding one soil sample location, the BCT agreed with the proposed approach. In March 2002, Shaw issued the final site-specific work plan, which was approved by ADEM and EPA in concurrence letters dated May 14, 2002 and October 18, 2002, respectively.

The analytical results are presented in the SI (Tables 5-1 through 5-3). All the analytical data were third-party validated. Analytical data that were "B" qualified, indicating that one or more blanks were contaminated, were not used in the PRA. This caused exclusion from the PRA of one detection of nickel in surface soil, one detection of methylene chloride in subsurface soil, one detection of methylene chloride in groundwater, and a few hits of sodium and potassium in groundwater and soil. Sodium and potassium, however, are essential nutrients not generally considered to be toxic at the low levels associated with "B" qualification. All "B"-qualified data dropped from the PRA were below their residential site-specific screening levels (SSSL); therefore, deleting these data had no effect on the outcome of this evaluation.

Site-Related Chemical Selection. Site-related chemicals are those presumed to be released by the Army during operation of FTMC. Site-related metals were selected for each medium by a three-tier process as described in a technical memorandum on background screening (Shaw, 2003). Briefly, the procedure consists of: (Tier 1) comparing the MDC of each chemical with its background screening criterion (BSC), consistent with EPA (2002a) Region 4 guidance; (Tier 2) one or more statistical tests, depending on the characteristics of the background and site data sets; and (Tier 3), geochemical evaluation. All organic chemicals were selected as site-related because most of them are not naturally occurring and were presumed to be present as a result of site activities. The statistical and geochemical evaluations are provided separately in the SI report.

The site-related chemicals chosen in this manner are identified in Tables 1 through 3 for total soil, and Tables 4 through 6 for groundwater. Site-related chemicals in total soil are limited to the VOCs, organochlorine pesticides and the chlorinated phenoxyacid herbicide MCPA. No chemicals were selected as site-related in groundwater.

Receptor Scenario Selection. The SI Summary clarified by the Parcel Reuse map shows that the proposed reuse for the area of investigation is almost entirely industrial, with a small triangle at the southeast corner proposed for passive recreation. The groundskeeper is selected as the upper bound on exposure to soil and groundwater for industrial reuse, and the recreational site user is selected as the most plausible receptor for passive recreation. Of these two receptors, the groundskeeper is always the more intensely exposed. Therefore, to simplify the evaluation, it is assumed that the entire area of investigation is proposed for industrial reuse, the groundskeeper scenario is evaluated, and the recreational site user scenario is not evaluated.

The groundskeeper is assumed to be exposed to total soil. A construction worker is included as a plausible receptor for short-term exposure, because construction activity is likely to be required for future development of the area of investigation for any kind of useful application. Construction would probably include excavation and grading; at least leveling of the berms. An on-site resident is also included, although development for residential use is unlikely, to provide additional perspective. Also, sites that "pass" a residential risk evaluation generally can be released for unrestricted use with no further action. The resident is evaluated for exposure to total soil.

Groundwater is evaluated as if it were developed as a source of potable water. It is assumed that the groundskeeper, construction worker and resident would be exposed to groundwater.

Chemical of Potential Concern Selection. Chemicals of potential concern (COPC) are site-related chemicals whose MDCs exceed their SSSLs, and which may contribute significantly to risk. The SSSLs are receptor-, medium-, and chemical-specific risk-based concentrations that capture all the exposure assumptions and toxicity assessment of a full-blown baseline risk assessment. COPCs are selected for both cancer risk and noncancer effects when the data are sufficient (Tables 1 through 3 for total soil, and Tables 4 through 6 for groundwater).

No chemicals were selected as COPCs in total soil for the groundskeeper (Table 1), construction worker (Table 2), or on-site resident (Table 3). All the metals were shown to be present at concentrations comparable to background, and the organic chemical concentrations were below their respective SSSLs. No chemicals were selected as COPCs in groundwater (Tables 4 through 6). The relatively few metals identified in groundwater were nutritionally required elements or present at concentrations below their BSCs. The MDC for barium, the only groundwater constituent for which maximum contaminant levels (MCL) are available, is well below its MCL (EPA, 2002b).

Risk Characterization. Risk characterization combines the exposure assumptions and toxicity assessment (incorporated in the SSSLs) with the exposure-point concentration (EPC) to quantify the incremental lifetime cancer risk (ILCR) and noncancer hazard index (HI). ILCR and HI estimates are computed for each COPC in each medium, and are summed across COPCs and media to yield a total ILCR and total HI for each receptor scenario. The PRA differs from an SRA in that the MDC is conservatively adopted as the EPC, at least initially. If refinement had been required, the EPC for soil might have been recalculated to reflect a conservative estimate of average, i.e., the 95th upper confidence limit on the arithmetic mean (UCL), which is considered a more reasonable and appropriate basis for risk assessment.

EPA (1990) considers ILCR estimates below 1E-6 to be negligible, ILCR estimates from 1E-6 to 1E-4 to fall within a risk management range, and ILCR estimates above 1E-4 to be generally unacceptable. EPA (1989) considers HI values that do not exceed the threshold level of 1 to indicate that the occurrence of adverse noncancer health effects is unlikely.

Summing HI values across chemicals, however, is considered to impart a conservative bias to the assessment, because only those chemicals that share a mechanism of toxicity are likely to interact in an additive manner (EPA, 1989). Since data regarding mechanism of toxicity are generally scarce, target organ or critical effect is often used as a surrogate. In other words, chemicals that act upon the same target organ or that have the same critical effect are considered to act by the same mechanism of toxicity unless sufficient evidence suggests that their mechanisms of toxicity are different. Therefore, had HI values summed across chemicals and media exceeded the threshold level of 1, the HI values might have been re-summed by target organ to refine the assessment.

Risk estimates may be rounded to one significant figure to reflect the uncertainty about their computation (EPA, 1989, 2002a). For example, a calculated ILCR of 9.50E-7 would be rounded to 1E-6 and interpreted as falling within the risk management range. Similarly, a calculated ILCR of 1.49E-4 would be rounded to 1E-4 and interpreted as falling within, but not exceeding, the risk management range. Also, an HI of 1.49E+0 would be rounded to 1 and interpreted as not exceeding the threshold level of 1. Risk and hazard estimates in this document are presented in scientific notation with two places to the right of the decimal to facilitate checking calculations. Rounding is done only in the text if needed to simplify interpretation.

As noted above, no chemicals were selected as COPCs in total soil or groundwater. Therefore, neither ILCR nor HI values were estimated for any of the receptor scenarios. It is concluded that

exposure to soil and groundwater is unlikely to result in adverse health effects for the groundskeeper, construction worker or on-site resident.

Uncertainty Evaluation. The most significant source of uncertainty in this exercise is the exclusion from the risk assessment of metals in soil and groundwater determined to be present at concentrations comparable to background. A non-conservative bias could have been imparted to the results and interpretation if these chemicals had been excluded in error; i.e., if in fact their ambient concentrations reflect site-related releases rather than background conditions. The chemicals excluded from selection as COPCs are discussed here in terms of their risk to an on-site resident. The other receptor scenarios are not included in this discussion because the final conclusion (see below) is that the site may be released for unrestricted use with no further action, which requires that risk estimates for the residential scenario fall within acceptable limits.

As noted above, the exclusion of chemicals from the site-related list is performed as a 3-tiered process. Tier 1 – comparison of the MDC with the BSC – is generally considered to be sufficiently conservative so that the uncertainty associated with chemicals excluded at this tier is minimal. Therefore, only chemicals excluded at Tier 2 or Tier 3 are discussed herein.

Total Soil. Several metals in total soil were excluded from the COPC list for residential exposure based on their Tier 2 or Tier 3 analysis (Table 3). None of these metals, however, would be subject to evaluation for cancer risk; i.e., none have cancer-based SSSLs. Those with MDCs that exceed their noncancer SSSLs are limited to aluminum, chromium, manganese and vanadium. In all cases the exceedance was less than a factor of 10, indicating that HI values calculated for these chemicals would fall below the threshold level of 1. Some level of uncertainty remains about these chemicals, however, because they could contribute to target organ HI values summed across the chemicals that exceed the threshold of 1. This issue is addressed below.

Groundwater. A few metals in groundwater were excluded from the COPC list because they were judged to be present at concentrations comparable to background. All of these metals, however, were excluded at the Tier 1 stage (Table 6). Therefore, the potential for erroneously excluding these metals from the site-related list is minimal and is not considered further.

All Chemicals. As discussed above, HI values for chemicals that share a target organ are generally summed. The nervous system is a common target organ for aluminum and manganese (please see Toxicity Profiles in IT [2000]), both of which were judged to be present in total soil at concentrations comparable to background. HI values of 4.08E-1 and 6.61E-1 could be estimated for residential exposure to aluminum and manganese, respectively, in total soil (calculations not shown). The sum, 1.07E-1, or 1 when rounded to one significant figure, is equivalent to the threshold value of 1. It is concluded that it is very unlikely that errors in differentiating background from site-related chemicals could have imparted a significantly non-conservative bias to the quantitative assessment or its interpretation.

Summary and Conclusions. In summary, 22 surface soil and 22 subsurface soil samples, and 2 groundwater samples were analyzed for TAL metals and nitroaromatic/nitramine explosives. Approximately 10 percent of the samples were analyzed also for VOCs, SVOCs, organochlorine pesticides and the chlorinated herbicides. Low levels of VOCs, pesticides and herbicides were

identified in surface soil. Low levels of VOCs were identified in subsurface soil. Organic chemicals were not identified in groundwater except for one sample blank-contaminated with methylene chloride that was not used in the PRA. The MDC of barium in groundwater fell well below its MCL. All the metals in soil and groundwater were determined to be present at concentrations comparable to background. The organic chemicals in soil were present at concentrations below their SSSLs. Therefore, no chemicals were selected as COPCs and neither ILCR nor HI values were estimated. The uncertainty evaluation showed that it is very unlikely that errors in differentiating background from site-related chemicals could have imparted a significantly non-conservative bias to the assessment or its interpretation. It is concluded that the area under investigation can be released for unrestricted use with no further action.

References

IT Corporation (IT), 2000, ***Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama***, Prepared for U.S. Army Corps of Engineers, Mobile District, August.

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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, DC, EPA/540/1-89/002, December.

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U.S. Environmental Protection Agency (EPA), 2002a, ***Region 4 Human Health Risk Assessment Bulletins – Supplement to RAGS, Interim Human Health Risk Assessment Bulletins***, Waste Management Division, EPA Region 4, Atlanta, GA, on line.

U.S. Environmental Protection Agency (EPA), 2002b, ***2002 Edition of the Drinking Water Standards and Health Advisories***, Office of Water, Washington, DC, EPA 822-R-02-038, Summer.

Table 1

Preliminary Risk Evaluation for Groundskeeper Exposure to Total Soil
Former Rifle/Machine Gun Range, Parcel 104Q
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	Site-Related Chemical?[a]	Groundskeeper Soil SSSL-c[b]	Groundskeeper Soil SSSL-n[c]	Groundskeeper Cancer COPC?[d]	Groundskeeper Noncancer COPC?[e]	Grpundskeeper ILCR[f]	Groundskeeper HI[g]
METALS								
Aluminum	3.18E+04	No(3)	NA	6.69E+03				
Arsenic	7.34E+00	No(1)	1.59E+00	3.06E+01				
Barium	1.54E+02	No(1)	NA	6.50E+02				
Beryllium	1.27E+00	No(3)	1.70E+01	2.39E+01				
Calcium	1.45E+03	No(E)	NA	NA				
Chromium[h]	7.43E+01	No(2)	3.41E+00	9.96E+01				
Cobalt	6.41E+00	No(1)	NA	2.90E+01				
Copper	1.62E+01	No(2)	NA	4.08E+03				
Iron	3.19E+04	No(1)	NA	3.06E+04				
Lead	4.60E+01	No(3)	NA	8.80E+02				
Magnesium	7.09E+02	No(E)	NA	NA				
Manganese	2.40E+03	No(3)	NA	7.05E+01				
Mercury	2.42E-01	No(3)	NA	2.85E+01				
Nickel	1.09E+01	No(1)	1.70E+02	2.02E+03				
Potassium	5.84E+02	No(E)	NA	NA				
Sodium	7.85E+01	No(E)	NA	NA				
Vanadium	6.56E+01	No(2)	NA	6.97E+02				
Zinc	2.39E+01	No(1)	NA	3.06E+04				
VOLATILE ORGANIC COMPOUNDS								
2-Butanone	3.20E-02	3.20E-02	NA	5.86E+04				
Acetone	7.90E-01	7.90E-01	NA	1.02E+04				
p-Cymene	1.80E-03	1.80E-03	NA	2.03E+04				
PESTICIDES								
4,4'-DDE	2.40E-03	2.40E-03	8.27E+00	NA				
4,4'-DDT	2.80E-03	2.80E-03	8.11E+00	5.02E+01				
Dieldrin	3.50E-03	3.50E-03	1.74E-01	5.06E+00				
Endosulfan II	2.40E-03	2.40E-03	NA	6.09E+02				
Endrin	1.90E-03	1.90E-03	NA	3.03E+01				
alpha-Chlordane	6.80E-04	6.80E-04	7.80E+00	4.74E+01				
delta-BHC	3.40E-04	3.40E-04	NA	3.05E+01				
HERBICIDES								
MCPA	9.30E-01	9.30E-01	NA	5.08E+01				
Total ILCR, HI							--	--

Table 1

Preliminary Risk Evaluation for Groundskeeper Exposure to Total Soil
Former Rifle/Machine Gun Range, Parcel 104Q
Fort McClellan, Calhoun County, Alabama

All concentrations expressed as mg/kg.
MDC = Maximum Detected Concentration; COPC = Chemical of Potential Concern; ILCR = Incremental Lifetime Cancer Risk; HI = Hazard Index.
-- = Not Calculated
NA = Not Available

[a] MDC presented only for site-related chemicals.
No(E) = Deselected as a site-related chemical as a nutritionally required element.
No(1) = Deselected as a site-related chemical at Tier 1.
No(2) = Deselected as a site-related chemical at Tier 2.
No(3) = Deselected as a site-related chemical at Tier 3.

[b] Site-specific screening level (SSSL) based on cancer risk for the groundskeeper exposure to soil.

[c] Site-specific screening level based on noncancer hazard for the groundskeeper exposure to soil.

[d] MDC presented only if it exceeds SSSL-c.

[e] MDC presented only if it exceeds SSSL-n.

[f] Incremental lifetime cancer risk for the groundskeeper exposed to chemicals in total soil.

[g] Hazard index for noncancer effects for the groundskeeper exposed to chemicals in total soil.

[h] SSSL based on chromium VI.

Table 2

Preliminary Risk Evaluation for the Construction Worker Exposure to Total Soil
Former Rifle/Machine Gun Range, Parcel 104Q
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	Site-Related Chemical?[a]	Construction Worker Soil SSSL-c[b]	Construction Worker Soil SSSL-n[c]	Construction Worker Cancer COPC?[d]	Construction Worker Noncancer COPC?[e]	Construction Worker ILCR[f]	Construction Worker HI[g]
METALS								
Aluminum	3.18E+04	No(3)	NA	3.34E+03				
Arsenic	7.34E+00	No(1)	1.98E+01	1.53E+01				
Barium	1.54E+02	No(1)	NA	3.25E+02				
Beryllium	1.27E+00	No(3)	2.13E+02	9.60E+00				
Calcium	1.45E+03	No(E)	NA	NA				
Chromium[h]	7.43E+01	No(2)	4.26E+01	4.91E+01				
Cobalt	6.41E+00	No(1)	NA	1.45E+01				
Copper	1.62E+01	No(2)	NA	2.04E+03				
Iron	3.19E+04	No(1)	NA	1.53E+04				
Lead	4.60E+01	No(3)	NA	8.80E+02				
Magnesium	7.09E+02	No(E)	NA	NA				
Manganese	2.40E+03	No(3)	NA	3.52E+01				
Mercury	2.42E-01	No(3)	NA	1.38E+01				
Nickel	1.09E+01	No(1)	2.13E+03	9.59E+02				
Potassium	5.84E+02	No(E)	NA	NA				
Sodium	7.85E+01	No(E)	NA	NA				
Vanadium	6.56E+01	No(2)	NA	3.16E+02				
Zinc	2.39E+01	No(1)	NA	1.52E+04				
VOLATILE ORGANIC COMPOUNDS								
2-Butanone	3.20E-02	3.20E-02	NA	2.86E+04				
Acetone	7.90E-01	7.90E-01	NA	4.95E+03				
p-Cymene	1.80E-03	1.80E-03	NA	9.93E+03				
PESTICIDES								
4,4'-DDE	2.40E-03	2.40E-03	9.67E+01	NA				
4,4'-DDT	2.80E-03	2.80E-03	9.50E+01	2.35E+01				
Dieldrin	3.50E-03	3.50E-03	2.08E+00	2.43E+00				
Endosulfan II	2.40E-03	2.40E-03	NA	2.97E+02				
Endrin	1.90E-03	1.90E-03	NA	1.46E+01				
alpha-Chlordane	6.80E-04	6.80E-04	8.83E+01	2.15E+01				
delta-BHC	3.40E-04	3.40E-04	NA	1.49E+01				
HERBICIDES								
MCPA	9.30E-01	9.30E-01	NA	2.48E+01				
Total ILCR, HI							--	--

Table 2

Preliminary Risk Evaluation for the Construction Worker Exposure to Total Soil
Former Rifle/Machine Gun Range, Parcel 104Q
Fort McClellan, Calhoun County, Alabama

All concentrations expressed as mg/kg.
MDC = Maximum Detected Concentration; COPC = Chemical of Potential Concern; ILCR = Incremental Lifetime Cancer Risk; HI = Hazard Index.
-- = Not Calculated
NA = Not Available
[a] MDC presented only for site-related chemicals.
No(E) = Deselected as a site-related chemical as a nutritionally required element.
No(1) = Deselected as a site-related chemical at Tier 1.
No(2) = Deselected as a site-related chemical at Tier 2.
No(3) = Deselected as a site-related chemical at Tier 3.
[b] Site-specific screening level (SSSL) based on cancer risk for the construction worker exposure to soil.
[c] Site-specific screening level based on noncancer hazard for the construction worker exposure to soil.
[d] MDC presented only if it exceeds SSSL-c.
[e] MDC presented only if it exceeds SSSL-n.
[f] Incremental lifetime cancer risk for the construction worker exposed to chemicals in total soil.
[g] Hazard index for noncancer effects for the construction worker exposed to chemicals in total soil.
[h] SSSL based on chromium VI.

Table 3

Preliminary Risk Evaluation for Residential Exposure to Total Soil
Former Rifle/Machine Gun Range, Parcel 104Q
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	Site-Related Chemical?[a]	Residential Soil SSSL-c[b]	Residential Soil SSSL-n[c]	Residential Cancer COPC?[d]	Residential Noncancer COPC?[e]	Residential ILCR[f]	Residential HI[g]
METALS								
Aluminum	3.18E+04	No(3)	NA	7.80E+03				
Arsenic	7.34E+00	No(1)	4.26E-01	2.34E+00				
Barium	1.54E+02	No(1)	NA	5.47E+02				
Beryllium	1.27E+00	No(3)	NA	9.60E+00				
Calcium	1.45E+03	No(E)	NA	NA				
Chromium[h]	7.43E+01	No(2)	NA	2.32E+01				
Cobalt	6.41E+00	No(1)	NA	4.68E+02				
Copper	1.62E+01	No(2)	NA	3.13E+02				
Iron	3.19E+04	No(1)	NA	2.34E+03				
Lead	4.60E+01	No(3)	NA	4.00E+02				
Magnesium	7.09E+02	No(E)	NA	NA				
Manganese	2.40E+03	No(3)	NA	3.63E+02				
Mercury	2.42E-01	No(3)	NA	2.33E+00				
Nickel	1.09E+01	No(1)	NA	1.54E+02				
Potassium	5.84E+02	No(E)	NA	NA				
Sodium	7.85E+01	No(E)	NA	NA				
Vanadium	6.56E+01	No(2)	NA	5.31E+01				
Zinc	2.39E+01	No(1)	NA	2.34E+03				
VOLATILE ORGANIC COMPOUNDS								
2-Butanone	3.20E-02	3.20E-02	NA	4.66E+03				
Acetone	7.90E-01	7.90E-01	NA	7.76E+02				
p-Cymene	1.80E-03	1.80E-03	NA	1.55E+03				
PESTICIDES								
4,4'-DDE	2.40E-03	2.40E-03	1.79E+00	NA				
4,4'-DDT	2.80E-03	2.80E-03	1.79E+00	3.83E+00				
Dieldrin	3.50E-03	3.50E-03	3.88E-02	3.86E-01				
Endosulfan II	2.40E-03	2.40E-03	NA	4.66E+01				
Endrin	1.90E-03	1.90E-03	NA	2.32E+00				
alpha-Chlordane	6.80E-04	6.80E-04	1.69E+00	3.79E+00				
delta-BHC	3.40E-04	3.40E-04	NA	2.33E+00				
HERBICIDES								
MCPA	9.30E-01	9.30E-01	NA	3.88E+00				
Total ILCR, HI							--	--

Table 3

Preliminary Risk Evaluation for Residential Exposure to Total Soil
Former Rifle/Machine Gun Range, Parcel 104Q
Fort McClellan, Calhoun County, Alabama

All concentrations expressed as mg/kg.
MDC = Maximum Detected Concentration; COPC = Chemical of Potential Concern; ILCR = Incremental Lifetime Cancer Risk; HI = Hazard Index.
-- = Not Calculated
NA = Not Available

[a] MDC presented only for site-related chemicals.
No(E) = Deselected as a site-related chemical as a nutritionally required element.
No(1) = Deselected as a site-related chemical at Tier 1.
No(2) = Deselected as a site-related chemical at Tier 2.
No(3) = Deselected as a site-related chemical at Tier 3.

[b] Site-specific screening level (SSSL) based on cancer risk for the residential exposure to soil.

[c] Site-specific screening level based on noncancer hazard for the residential exposure to soil.

[d] MDC presented only if it exceeds SSSL-c.

[e] MDC presented only if it exceeds SSSL-n.

[f] Incremental lifetime cancer risk for the resident exposed to chemicals in total soil.

[g] Hazard index for noncancer effects for the resident exposed to chemicals in total soil.

[h] SSSL based on chromium VI.

Table 4

Preliminary Risk Evaluation for the Groundskeeper Exposure to Groundwater
Former Rifle/Machine Gun Range, Parcel 104Q
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	Maximum Contaminant Level[a]	Site-Related Chemical?[b]	Groundskeeper Groundwater SSSL-c[c]	Groundskeeper Groundwater SSSL-n[d]	Groundskeeper Cancer COPC?[e]	Groundskeeper Noncancer COPC?[f]	Groundskeeper ILCR[g]	Groundskeeper HI[h]
METALS									
Barium	1.12E-02	2.00E+00	No(1)	NA	7.12E-01				
Calcium	2.40E+01	NA	No(E)	NA	NA				
Iron	6.15E-03	NA	No(1)	NA	3.05E+00				
Magnesium	1.38E+01	NA	No(E)	NA	NA				
Manganese	5.52E-02	NA	No(1)	NA	4.44E-01				
Potassium	1.17E+00	NA	No(E)	NA	NA				
Total ILCR, HI								--	--

All concentrations expressed as mg/L.
MDC = Maximum Detected Concentration; COPC = Chemical of Potential Concern; ILCR = Incremental Lifetime Cancer Risk; HI = Hazard Index.
-- = Not Calculated
NA = Not Available

[a] U.S. Environmental Protection Agency (EPA), 2002, ***2002 Edition of the Drinking Water Standards and Health Advisories***, Office of Water, Washington, DC, EPA 822-R-02-038, Summer.

[b] MDC presented only for site-related chemicals.
No(E) = Deselected as a site-related chemical as a nutritionally required element.
No(1) = Deselected as a site-related chemical at Tier 1.
No(2) = Deselected as a site-related chemical at Tier 2.
No(3) = Deselected as a site-related chemical at Tier 3.

[c] Site-specific screening level (SSSL) based on cancer risk for the groundskeeper exposure to groundwater.

[d] Site-specific screening level based on noncancer hazard for the groundskeeper exposure to groundwater.

[e] MDC presented only if it exceeds SSSL-c.

[f] MDC presented only if it exceeds SSSL-n.

[g] Incremental lifetime cancer risk for the groundskeeper exposed to chemicals in groundwater.

[h] Hazard index for noncancer effects for the groundskeeper exposed to chemicals in groundwater.

Table 5

Preliminary Risk Evaluation for the Construction Worker Exposure to Groundwater
Former Rifle/Machine Gun Range, Parcel 104Q
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	Maximum Contaminant Level[a]	Site-Related Chemical?[b]	Construction Worker Groundwater SSSL-c[c]	Construction Worker Groundwater SSSL-n[d]	Construction Worker Cancer COPC?[e]	Construction Worker Noncancer COPC?[f]	Construction Worker ILCR[g]	Construction Worker HI[h]
METALS									
Barium	1.12E-02	2.00E+00	No(1)	NA	7.12E-01				
Calcium	2.40E+01	NA	No(E)	NA	NA				
Iron	6.15E-03	NA	No(1)	NA	3.05E+00				
Magnesium	1.38E+01	NA	No(E)	NA	NA				
Manganese	5.52E-02	NA	No(1)	NA	4.44E-01				
Potassium	1.17E+00	NA	No(E)	NA	NA				
Total ILCR, HI								--	--

All concentrations expressed as mg/L.
MDC = Maximum Detected Concentration; COPC = Chemical of Potential Concern; ILCR = Incremental Lifetime Cancer Risk; HI = Hazard Index.
-- = Not Calculated
NA = Not Available

[a] U.S. Environmental Protection Agency (EPA), 2002, ***2002 Edition of the Drinking Water Standards and Health Advisories***, Office of Water, Washington, DC, EPA 822-R-02-038, Summer.

[b] MDC presented only for site-related chemicals.
No(E) = Deselected as a site-related chemical as a nutritionally required element.
No(1) = Deselected as a site-related chemical at Tier 1.
No(2) = Deselected as a site-related chemical at Tier 2.
No(3) = Deselected as a site-related chemical at Tier 3.

[c] Site-specific screening level (SSSL) based on cancer risk for the construction worker exposure to groundwater.

[d] Site-specific screening level based on noncancer hazard for the construction worker exposure to groundwater.

[e] MDC presented only if it exceeds SSSL-c.

[f] MDC presented only if it exceeds SSSL-n.

[g] Incremental lifetime cancer risk for the construction worker exposed to chemicals in groundwater.

[h] Hazard index for noncancer effects for the construction worker exposed to chemicals in groundwater.

Table 6

Preliminary Risk Evaluation for the Residential Exposure to Groundwater
Former Rifle/Machine Gun Range, Parcel 104Q
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	Maximum Contaminant Level[a]	Site-Related Chemical?[b]	Residential Groundwater SSSL-c[c]	Residential Groundwater SSSL-n[d]	Residential Cancer COPC?[e]	Residential Noncancer COPC?[f]	Residential ILCR[g]	Residential HI[h]
METALS									
Barium	1.12E-02	2.00E+00	No(1)	NA	1.10E-01				
Calcium	2.40E+01	NA	No(E)	NA	NA				
Iron	6.15E-03	NA	No(1)	NA	4.69E-01				
Magnesium	1.38E+01	NA	No(E)	NA	NA				
Manganese	5.52E-02	NA	No(1)	NA	7.35E-02				
Potassium	1.17E+00	NA	No(E)	NA	NA				
Total ILCR, HI								--	--

All concentrations expressed as mg/L.
MDC = Maximum Detected Concentration; COPC = Chemical of Potential Concern; ILCR = Incremental Lifetime Cancer Risk; HI = Hazard Index.
-- = Not Calculated
NA = Not Available

[a] U.S. Environmental Protection Agency (EPA), 2002, ***2002 Edition of the Drinking Water Standards and Health Advisories***, Office of Water, Washington, DC, EPA 822-R-02-038, Summer.

[b] MDC presented only for site-related chemicals.
No(E) = Deselected as a site-related chemical as a nutritionally required element.
No(1) = Deselected as a site-related chemical at Tier 1.
No(2) = Deselected as a site-related chemical at Tier 2.
No(3) = Deselected as a site-related chemical at Tier 3.

[c] Site-specific screening level (SSSL) based on cancer risk for the residential exposure to groundwater.

[d] Site-specific screening level based on noncancer hazard for the residential exposure to groundwater.

[e] MDC presented only if it exceeds SSSL-c.

[f] MDC presented only if it exceeds SSSL-n.

[g] Incremental lifetime cancer risk for the resident exposed to chemicals in groundwater.

[h] Hazard index for noncancer effects for the resident exposed to chemicals in groundwater.