APPENDIX H

PRELIMINARY RISK ASSESSMENT

Technical Memorandum

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To: Former Trap and Skeet Range, Parcel 127Q, Main Post, Fort McClellan
Preliminary Risk Assessment File

Date: 21 November 2001

Subject: **PRELIMINARY RISK ASSESSMENT FOR SUBJECT SITE**

This memorandum provides a Preliminary Risk Assessment (PRA) for exposure to surface and subsurface soil and groundwater at the Former Trap and Skeet Range. The PRA approach 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 Fort McClellan (FTMC). It is assumed that the reader is familiar with FTMC and the fundamentals of the SRA protocol. The reader is referred to the Installation-Wide Work Plan (IWWP) (IT, 1998) 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.

Media of Interest and Data Selection Data consist of 6 surface soil and 2 depositional soil samples (collectively evaluated as surface soil), 6 subsurface soil samples, and 4 groundwater samples. The soils were analyzed for metals, semivolatile organic compounds (SVOC) and explosives. Groundwater samples were analyzed for metals and explosives. The validated data are summarized by sample location in Tables 5-1 (surface soil), 5-2 (subsurface soil) and 5-3 (groundwater) from the Site Investigation (SI).

Site-Related Chemical Selection Site-related chemicals are those presumed to be released because of activities performed by the army during operation of FTMC. They are identified in Table 1 (surface soil), Table 2 (subsurface soil) and Table 3 (groundwater) by comparing the maximum detected concentration (MDC) of each chemical with its background screening criterion (BSC), computed as two times the mean of the background data set, in accordance with EPA (2001a) Region IV guidance. BSCs were taken from Tables 5-1, 5-2 and 5-3 from the SI. Upper tolerance limits (UTL), the highest metal concentrations reasonably considered to be within background, are also included in Tables 1, 2 and 3 for information, but were not used to select site-related chemicals. The UTL provides a more refined statistical approach than the BSC for comparing site and background data. UTLs were developed for the entire FTMC facility, combining data from the Main Post and Pelham Range. The UTLs for total soil were adopted for subsurface soil.

Chemical of Potential Concern Selection Chemicals of potential concern (COPC) are site-related chemicals whose MDCs exceed their site-specific screening levels (SSSL), 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 permit (Tables 1, 2 and 3).

Receptor Scenario Selection The Former Trap and Skeet Range is slated to be used by the Alabama Army National Guard for training purposes. The most plausible receptor is a National Guardsperson (Goetchius, 2001). An on-site resident is also included as the upper-bound evaluation of exposure and risk, and to provide additional perspective. SSSLs for both receptor scenarios were used in COPC selection and to characterize risk.

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 chemical in each medium, and are summed to yield a total ILCR and total HI for each receptor scenario. The PRA differs from an SRA in that no attempt is made to estimate an EPC for soil that reflects a conservative estimate of average concentration. A 95 percent upper confidence limit on the mean (UCL) is usually used for this purpose. Instead, the MDC is adopted as the EPC, which imparts a conservative bias to the PRA.

The only plausible receptor scenario for the Former Trap and Skeet Range is the National Guardsperson. COPCs selected in surface soil for the National Guardsperson are limited to several potentially carcinogenic polyaromatic hydrocarbons (PAH) (Table 1). The total ILCR for exposure to surface soil of 8.87E-5 is near the high end of the EPA (1990) risk management range. COPCs for the National Guardsperson for exposure to subsurface soil are limited to benzo(a)pyrene – one of the more potent of the potentially carcinogenic PAHs – and aluminum, which is associated only with noncancer effects (Table 2). The ILCR of 3.60E-6 is near the low end of the risk management range. The HI for aluminum of 1.56E-1 is well below the threshold level of 1. No COPCs were selected for National Guardsperson exposure to groundwater. Aluminum in subsurface soil is dismissed from further consideration for the National Guardsperson evaluation because it is the only chemical in any medium for which an HI was estimated.

Significant COPCs for the National Guardsperson are limited to several potentially carcinogenic PAHs in surface and subsurface soil. The total ILCR summed across all PAHs in both soil horizons of 9.23E-5 is near the high end of the risk management range. As noted above, the EPC for each PAH is its MDC. However, it is not plausible that the National Guardsperson would be exposed simultaneously to the highest concentrations in both surface and subsurface soil, because exposure to subsurface soil is not possible without excavation or other intrusive activities that would mix the soil horizons. In other words, the total ILCR estimate of 9.23E-5 reflects a worst-case exposure scenario that cannot be attained. A more realistic ILCR would be less than the estimated value, although how much less is uncertain. Since no chemicals yield an unacceptable ILCR or HI, the Former Trap and Skeet Range can be released for use by the National Guard requiring no further action.

The on-site resident was also evaluated as the upper-bound on exposure and risk and to provide additional perspective. COPCs for residential exposure to surface soil include several potentially carcinogenic PAHs and lead (Table 1). COPCs for residential exposure to subsurface soil include some of the same PAHs and the metals aluminum, iron and thallium (Table 2). No

chemicals in groundwater were selected as COPCs (Table 3). The total ILCR for exposure to PAHs in surface soil of 9.27E-4 exceeds the risk management range. Examination of Table 5-1 of the SI shows that the unacceptable ILCR for PAHs arises from surface soil at only one sampling location: HR-127Q-MW03. Cleanup of surface soil at this one location would yield an ILCR summed across all chemicals and media of 9.54E-5 (calculation not shown), at the high end of the risk management range but still within the generally acceptable limit.

Two surface soil sampling locations yield lead levels above the SSSL of 400 mg/kg: HR-127Q-GP02 and HR-127Q-MW03. The distribution of lead was not sufficiently characterized to estimate average values for residential exposure units; therefore, the prudent and protective approach is to consider all detections above the SSSL to be unacceptable for residential exposure.

COPCs in subsurface soil included three metals. Only iron returned an HI greater than the threshold limit of 1. However, the MDC is less than the UTL, suggesting that it may be present at background levels. Also, EPA Region IV considers the toxicity value for iron to be unsuitable for use in quantitative risk assessment because it is based on average dietary consumption rather than toxicological properties. In other words, the toxicity of iron is believed to be much less than implied by the SSSL, and the HI estimated for iron is removed from the evaluation of subsurface soil. The other metals identified as COPCs returned HI values whose sum is less than the threshold limit of 1 (data not shown).

In summary, residential exposure to subsurface soil and groundwater is unlikely to pose any unacceptable threat to human health. However, PAHs in one sample location and lead in two sample locations raise concern that residential exposure to surface soil may lead to unacceptable cancer risk and the potential for adverse noncancer effects.

References

Goetchius, P.F., 2001, Memorandum to FTMC Risk Assessment File, subject: National Guardsperson at Pelham Range, 11 October.

IT Corporation (IT), 1998, ***Installation-Wide Work Plan***, Final, Fort McClellan, Calhoun County, Alabama, Prepared for U.S. Army Corps of Engineers, Mobile District, August*

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), 2001, ***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.

*Note: the Installation-Wide Work Plan was revised in September 2001 but has not yet been released for distribution. The description of the protocol and application of the SRA, however, was not substantively changed.

Table 1

Preliminary Risk Evaluation for Exposure to Surface Soil
Former Trap and Skeet Range, Parcel 127Q
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC[a]	UTL	Site-Related Chemical?[b]	Res Soil SSSL-c[c]	Res Soil SSSL-n[d]	Res Cancer COPC?[e]	Res Noncancer COPC?[f]	Res ILCR[g]	Res HI[h]	NG Soil SSSL-c[i]	NG Soil SSSL-n[j]	NG Cancer COPC?[e]	NG Noncance COPC?[f]	NG ILCR[k]	NG HI[l]
METALS																
Aluminum	1.24E+04	1.63E+04	2.14E+04			7.80E+03						1.47E+04				
Arsenic	6.82E+00	1.37E+01	2.54E+01		4.26E-01	2.34E+00					3.70E+00	7.96E+01				
Barium	6.92E+01	1.24E+02	1.94E+02			5.47E+02						1.43E+03				
Beryllium	7.87E-01	8.00E-01	8.68E-01			9.60E+00					3.42E+01	4.42E+01				
Calcium	6.35E+03	1.72E+03	3.54E+03	6.35E+03												
Chromium	2.56E+01	3.70E+01	6.44E+01			2.32E+01					6.85E+00	2.26E+02				
Cobalt	9.62E+00	1.52E+01	3.25E+01			4.68E+02						6.30E+01				
Copper	1.97E+01	1.27E+01	2.25E+01	1.97E+01		3.13E+02						1.06E+04				
Iron	3.23E+04	3.42E+04	5.54E+04			2.34E+03						7.96E+04				
Lead	4.34E+02	4.01E+01	6.38E+01	4.34E+02		4.00E+02		4.34E+02				8.80E+02				
Magnesium	3.27E+03	1.03E+03	9.60E+03	3.27E+03												
Manganese	6.86E+02	1.58E+03	4.66E+03			3.63E+02						1.53E+02				
Mercury	6.50E-02	8.00E-02	3.22E-01			2.33E+00						7.12E+01				
Nickel	1.76E+01	1.03E+01	2.00E+01	1.76E+01		1.54E+02					3.42E+02	5.00E+03				
Potassium	6.79E+02	8.00E+02	6.01E+03													
Thallium	1.99E+00	3.43E+00	4.53E-01			5.08E-01						1.73E+01				
Vanadium	3.38E+01	5.88E+01	9.94E+01			5.31E+01						1.65E+03				
Zinc	5.27E+01	4.06E+01	7.37E+01	5.27E+01		2.34E+03						7.90E+04				
SVOCs																
Anthracene	4.90E-01	9.35E-01				2.33E+03						7.70E+04				
Benzo(a)anthracene	4.70E+01	1.19E+00		4.70E+01	8.51E-01		4.70E+01		5.52E-05		8.89E+00		4.70E+01		5.29E-06	
Benzo(a)pyrene	5.80E+01	1.42E+00		5.80E+01	8.51E-02		5.80E+01		6.82E-04		8.89E-01		5.80E+01		6.52E-05	
Benzo(b)fluoranthene	7.40E+01	1.66E+00		7.40E+01	8.51E-01		7.40E+01		8.70E-05		8.89E+00		7.40E+01		8.32E-06	
Benzo(ghi)perylene	2.80E+01	9.55E-01		2.80E+01		2.32E+02						7.59E+03				
Chrysene	6.80E+01	1.40E+00		6.80E+01	8.61E+01						9.06E+02					
Dibenz(a,h)anthracene	7.30E+00	7.20E-01		7.30E+00	8.61E-02		7.30E+00		8.48E-05		9.06E-01		7.30E+00		8.06E-06	
Fluoranthene	3.30E+01	2.03E+00		3.30E+01		3.09E+02						1.01E+04				
Indeno(1,2,3-cd)pyrene	1.60E+01	9.37E-01		1.60E+01	8.51E-01		1.60E+01		1.88E-05		8.89E+00		1.60E+01		1.80E-06	
Phenanthrene	2.10E+01	1.08E+00		2.10E+01		2.32E+03						7.59E+04				
Pyrene	4.50E+01	1.63E+00		4.50E+01		2.33E+02						7.73E+03				
EXPLOSIVES																
Tetryl	2.40E-01			2.40E-01		7.77E+01						2.59E+03				
Total ILCR, HI									9.27E-04						8.87E-05	

Table 1

Preliminary Risk Evaluation for Exposure to Surface Soil
Former Trap and Skeet Range, Parcel 127Q
Fort McClellan, Calhoun County, Alabama

All concentrations expressed as mg/kg.
MDC = maximum detected concentration; BSC = background screening criterion; UTL = 95% upper tolerance limit (incorporates data from Main Post and Pelham Range).
SVOCs = semivolatile organic compounds.

[a] BSCs for metals estimated from background data (SAIC, 1998); BSCs for polyaromatic hydrocarbons from IT (2000).

[b] MDC presented only if it exceeds BSC.

[c] Site-specific screening level based on cancer risk for residential exposure to soil.

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

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

[f] Incremental lifetime cancer risk for resident exposed to chemical in soil.

[g] Incremental lifetime cancer risk for resident exposed to chemical in soil.

[h] Hazard index for noncancer effects for resident exposed to chemical in soil.

[i] Site-specific screening level based on cancer risk for National Guardsperson exposure to soil.

[j] Site-specific screening level based on noncancer hazard for National Guardsperson exposure to soil.

[k] Incremental lifetime cancer risk for National Guardsperson exposed to chemical in soil.

[l] Hazard index for noncancer effects for National Guardsperson exposed to chemical in soil.

Table 2

Preliminary Risk Evaluation for Exposure to Subsurface Soil
Former Trap and Skeet Range, Parcel 127Q
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC	UTL	Site-Related Chemical?[a]	Res Soil SSSL-c[b]	Res Soil SSSL-n[c]	Res Cancer COPC?[d]	Res Noncancer COPC?[e]	Res ILCR[f]	Res HI[g]	NG Soil SSSL-c[h]	NG Soil SSSL-n[i]	NG Cancer COPC?[d]	NG Noncance COPC?[e]	NG ILCR[j]	NG HI[k]
METALS																
Aluminum	2.30E+04	1.36E+04	1.80E+04	2.30E+04		7.80E+03		2.30E+04		2.95E-01		1.47E+04		2.30E+04		1.56E-01
Antimony	5.61E+00	1.31E+00	2.64E+00			3.11E+00						1.04E+02				
Arsenic	7.13E+00	1.83E+01	3.24E+01		4.26E-01	2.34E+00					3.70E+00	7.96E+01				
Barium	1.63E+02	2.34E+02	2.42E+02			5.47E+02						1.43E+03				
Beryllium	1.63E+00	8.60E-01	1.50E+00	1.63E+00		9.60E+00					3.42E+01	4.42E+01				
Cadmium	2.27E-01	2.20E-01	6.83E-01			6.25E+00					4.56E+01	1.08E+02				
Calcium	3.30E+03	6.37E+02	2.41E+03	3.30E+03												
Chromium	2.56E+01	3.83E+01	5.63E+01			2.32E+01					6.85E+00	2.26E+02				
Cobalt	2.57E+01	1.75E+01	3.63E+01	2.57E+01		4.68E+02						6.30E+01				
Copper	5.27E+01	1.94E+01	2.59E+01	5.27E+01		3.13E+02						1.06E+04				
Iron	4.54E+04	4.48E+04	5.63E+04	4.54E+04		2.34E+03		4.54E+04		1.94E+00		7.96E+04				
Lead	3.45E+01	3.85E+01	6.05E+01			4.00E+02						8.80E+02				
Magnesium	1.25E+04	7.66E+02	5.54E+03	1.25E+04												
Manganese	5.65E+02	1.36E+03	4.12E+03			3.63E+02						1.53E+02				
Mercury	5.30E-02	7.00E-02	1.71E-01			2.33E+00						7.12E+01				
Nickel	5.23E+01	1.29E+01	2.07E+01	5.23E+01		1.54E+02					3.42E+02	5.00E+03				
Potassium	1.62E+03	7.11E+02	5.78E+03	1.62E+03												
Sodium	2.28E+02	7.02E+02	6.23E+02													
Thallium	3.07E+00	1.40E+00	6.62E+00	3.07E+00		5.08E-01		3.07E+00		6.04E-01		1.73E+01				
Vanadium	3.03E+01	6.49E+01	9.05E+01			5.31E+01						1.65E+03				
Zinc	1.36E+02	3.49E+01	7.13E+01	1.36E+02		2.34E+03						7.90E+04				
SVOCs	0.00E+00															
Anthracene	5.00E-01			5.00E-01		2.33E+03						7.70E+04				
Benzo(a)anthracene	2.30E+00			2.30E+00	8.51E-01		2.30E+00		2.70E-06		8.89E+00					
Benzo(a)pyrene	3.20E+00			3.20E+00	8.51E-02		3.20E+00		3.76E-05		8.89E-01		3.20E+00		3.60E-06	
Benzo(b)fluoranthene	5.40E+00			5.40E+00	8.51E-01		5.40E+00		6.35E-06		8.89E+00					
Benzo(ghi)perylene	1.50E+00			1.50E+00		2.32E+02						7.59E+03				
Chrysene	2.70E+00			2.70E+00	8.61E+01						9.06E+02					
Fluoranthene	3.20E+00			3.20E+00		3.09E+02						1.01E+04				
Indeno(1,2,3-cd)pyrene	1.50E+00			1.50E+00	8.51E-01		1.50E+00		1.76E-06		8.89E+00					
Phenanthrene	1.80E+00			1.80E+00		2.32E+03						7.59E+04				
Pyrene	3.00E+00			3.00E+00		2.33E+02						7.73E+03				
Total ILCR, HI									4.84E-05	2.84E+00					3.60E-06	1.56E-01

Table 2

Preliminary Risk Evaluation for Exposure to Subsurface Soil
Former Trap and Skeet Range, Parcel 127Q
Fort McClellan, Calhoun County, Alabama

All concentrations expressed as mg/kg.
MDC = maximum detected concentration; BSC = background screening criterion; UTL = 95% upper tolerance limit (values for total soil; incorporates data from Main Post and Pelham Range).
SVOCs = semivolatile organic compounds.

[a] MDC presented only if it exceeds BSC.

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

[c] Site-specific screening level based on noncancer hazard for 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 resident exposed to chemical in soil.

[g] Hazard index for noncancer effects for resident exposed to chemical in soil.

[h] Site-specific screening level based on cancer risk for National Guardsperson exposure to soil.

[i] Site-specific screening level based on noncancer hazard for National Guardsperson exposure to soil.

[j] Incremental lifetime cancer risk for National Guardsperson exposed to chemical in soil.

[k] Hazard index for noncancer effects for National Guardsperson exposed to chemical in soil.

Table 3

Preliminary Risk Evaluation for Exposure to Groundwater
Former Trap and Skeet Range, Parcel 127Q
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC	UTL	Site-Related Chemical?[a]	Res GW SSSL-c[b]	Res GW SSSL-n[c]	Res Cancer COPC?[d]	Res Noncancer COPC?[e]	Res ILCR[f]	Res HI[g]	NG GW SSSL-c[h]	NG GW SSSL-n[i]	NG Cancer COPC?[d]	NG Noncance COPC?[e]	NG ILCR[j]	NG HI[k]
METALS																
Aluminum	6.77E-01	2.34E+00	9.60E+00			1.56E+00						1.90E+01				
Arsenic	2.47E-03	1.78E-02	2.22E-01		4.46E-05	4.69E-04					3.29E-04	5.70E-03				
Barium	2.64E-02	1.27E-01	4.72E-01			1.10E-01						1.30E+00				
Calcium	1.03E+02	5.65E+01	4.52E+02	1.03E+02												
Iron	5.70E-01	7.04E+00	2.58E+01			4.69E-01						5.70E+00				
Magnesium	7.13E+01	2.13E+01	1.49E+02	7.13E+01												
Manganese	2.07E-01	5.81E-01	4.13E+00			7.35E-02						8.93E-01				
Mercury	2.30E-04			2.30E-04		4.69E-04						5.70E-03				
Potassium	2.47E+00	7.20E+00	6.85E+01													
Selenium	2.05E-03			2.05E-03		7.82E-03						9.51E-02				
Sodium	4.04E+01	1.48E+01	4.90E+01	4.04E+01												
EXPLOSIVES	0.00E+00															
2-Nitrotoluene	2.90E-04			2.90E-04		1.53E-02						1.90E-01				
Total ILCR, HI																

All concentrations expressed as mg/L.

MDC = maximum detected concentration; BSC = background screening criterion; UTL = 95% upper tolerance limit (incorporates data from Main Post and Pelham Range).

[a] MDC presented only if it exceeds BSC.

[b] Site-specific screening level based on cancer risk for residential exposure to groundwater.

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

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

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

[f] Incremental lifetime cancer risk for resident exposed to chemical in groundwater.

[g] Hazard index for noncancer effects for resident exposed to chemical in groundwater.

[h] Site-specific screening level based on cancer risk for National Guardsperson exposure to groundwater.

[i] Site-specific screening level based on noncancer hazard for National Guardsperson exposure to groundwater.

[j] Incremental lifetime cancer risk for National Guardsperson exposed to chemical in groundwater.

[k] Hazard index for noncancer effects for National Guardsperson exposed to chemical in groundwater.