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June 4, 2008

SHAW-MC-CK10-1137
Project No. 796887

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 CK10
Fort McClellan, Alabama

Subject: Results of XRF Soil Sampling at OA-03, Former Pistol Range

Dear Mr. Coker:

This letter report presents the results of x-ray fluorescence (XRF) soil sampling and analysis conducted at OA-03, Former Pistol Range located at the former Fort McClellan (FTMC) in Anniston, Alabama. This former pistol range, which was identified in the FTMC *Archives Search Report* (ASR) (U.S. Army Corps of Engineers, 1999) but not in the *Environmental Baseline Survey* (EBS) (Environmental Science and Engineering, Inc., 1998), apparently had never been investigated for potential environmental concerns. The objective of this sampling was to collect sufficient data to determine the presence or absence of contamination to allow completion of a Department of Defense (DoD) Relative Risk Site Evaluation. Based on its description as a pistol range in the ASR, the primary contaminants of potential concern at this site are expected to be metals associated with small arms ammunition, particularly lead (Interstate Technology and Regulatory Council [ITRC], 2003).

1.0 Site Description and History

OA-03, Former Pistol Range is located along Ruskin Avenue, east of Outback Avenue and north of Regent Street, in the northwestern portion of the former FTMC Main Post (Figure 1). The ASR indicates that the pistol range appears on maps during the period between World War I and World War II. Review of available aerial photographs clearly shows this range on the September 1940 aerial photograph. The ASR also notes that the range was abandoned by World War II and review of post-1940 aerial photographs confirms this to be the case. This range was not identified in the EBS and no additional information could be found detailing actual site use or weapons fired at this range.

2.0 Field Activities

Shaw collected 44 surface soil samples for XRF analysis at the locations shown on Figure 2. The samples were collected at a depth of 0 to 6 inches below ground surface. The sample locations were determined based on the 1940 aerial photograph and corresponded to apparent firing lines or target lines as well as the probable impact area in the hillside further to the east. Thirty sample locations were planned in the site-specific work plan (Shaw, 2007); however, 14 additional locations were sampled during the field effort based on the initial field screening results. The primary contaminant of concern was lead since lead accounts for the majority of small arms ammunition.

XRF Field Sampling and Analysis. Initially, the proposed sample locations were acquired using a hand-held global positioning system (GPS) unit based on the survey coordinate data presented in the work plan. The sample locations were then marked with wooden stakes or pin flags. An Innov-X™ Alpha XRF analyzer was used to analyze the soil samples. This field portable unit was calibrated daily and operated in accordance with manufacturer's instructions and procedures specified in the FTMC Installation-Wide Sampling and Analysis Plan (SAP) (IT, 2002). The samples were collected from the uppermost 2 inches of soil using a stainless-steel spoon and then placed into a re-sealable plastic bag. Any remaining leaf litter, rocks, or other visible non-soil materials were removed and the sample was homogenized in the plastic bag by thoroughly mixing (note: only a single occurrence of a lead projectile was noted during the field sampling activities). After homogenization, the soil in the re-sealable plastic bag was compressed, making a smooth, consistent surface for analysis. The XRF instrument probe was placed directly on the prepared surface of the bag to perform the analysis. When the analysis was complete, the lead concentration was recorded and the soil sample was placed in temporary storage until all XRF soil samples were analyzed. When the analyses were complete and all of the XRF data reviewed, the samples for off-site confirmation analysis were selected. The XRF field data, including sample results and daily calibration information, were recorded in a logbook. Copies of the logbook pages are included in Appendix A.

Off-Site Confirmation Analysis. Nine of the 44 XRF screening samples (20 percent) were selected for confirmatory analysis at an off-site analytical laboratory (EMAX Laboratories, Inc.). The confirmation samples were analyzed for target analyte list (TAL) metals using the U.S. Environmental Protection Agency's *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846) Methods 6010B/7471A. Samples containing a range of lead concentrations from less than 100 milligrams per kilogram (mg/kg) to the maximum detected concentration (891 mg/kg) were selected for confirmatory analysis. Samples selected for off-site analysis were prepared by air drying, grinding with a ceramic pestle to achieve relatively uniform particle size, and passing the material through a No. 10 sieve (2-millimeter pore size) to remove larger non-soil items (e.g., rocks, sticks). The prepared samples were then transferred into new 120-milliliter, clear glass, wide-mouth sample containers, labeled, and shipped to the analytical laboratory following the standard chain-of-custody procedures specified in the SAP. Sample collection logs and analysis request/chain-of-custody forms for the confirmation samples are included in Appendix A.

3.0 Data Reporting and Validation

The confirmation samples were collected, documented, handled, analyzed, and reported in a manner consistent with the site-specific work plan; the FTMC SAP and quality assurance plan; and standard, accepted methods and procedures. Data were reported and evaluated in accordance with Corps of Engineers South Atlantic Savannah Level B criteria (USACE, 2001) and the stipulated requirements for the generation of definitive data as described in the SAP. Chemical data were reported via hard-copy data packages by the laboratory using Contract Laboratory Program-like forms.

Data Validation. The reported analytical data were validated in accordance with EPA National Functional Guidelines by Level III criteria. Selected results were rejected or otherwise qualified based on the implementation of accepted data validation procedures and practices. The validation-assigned qualifiers were added to the ShawView^{TM} database for tracking and reporting. A summary of the validated analytical data as well as the laboratory analytical data sheets for the confirmation samples are provided in Appendix B.

4.0 Summary of Analytical Results

The XRF and confirmation sample results for lead are summarized by location in Table 1 and are shown spatially on Figure 2. Lead and other metals laboratory data are compared to FTMC background levels and risk-based screening criteria in Table 2 and presented in Appendix B.

Lead. Lead concentrations in the XRF-analyzed soil samples ranged from 16 to 891 mg/kg, with 15 samples containing lead at concentrations above the established background level of 40 mg/kg for surface soil at FTMC (Science Applications International Corporation, 1998). Nine of the lead results (107 to 1,170 mg/kg) exceeded the ecological screening value (ESV) for lead of 50 mg/kg (IT, 2000). Lead concentrations in three of the XRF samples (XRF33, XRF36, and XRF42) exceeded the residential human health site-specific screening level (SSSL) of 400 mg/kg developed for FTMC (IT, 2000). However, subsequent laboratory analysis indicated that lead levels in samples XRF33 and XRF36 were actually below the residential SSSL. Only one XRF sample location (XRF42) had a lead concentration (891 mg/kg) above the industrial/commercial SSSL of 880 mg/kg. The lead concentration in the XRF42 confirmation sample (1,170 mg/kg) also exceeded the industrial SSSL. The highest lead concentrations were present in samples collected from the hillside east of Ruskin Road, particularly in the southeastern area of the site. Figure 2 shows computer-generated lead isocontours using the XRF and confirmation analytical data.

Other Metals. Several other metals were detected in the nine confirmation samples at concentrations above the various FTMC screening criteria (Table 2). The concentrations of five metals exceeded SSSLs and background concentrations in one or more samples:

- Aluminum (20,700 mg/kg) exceeded its SSSL (7,803 mg/kg) and background (16,306 mg/kg) in one sample

- Cadmium (6.43 to 11.8 mg/kg) exceeded its SSSL (6.25 mg/kg) and background (0.29 mg/kg) in four samples

- Iron (37,400 and 54,700 mg/kg) exceeded its SSSL (2,345 mg/kg) and background (34,154 mg/kg) in two samples

- Manganese (3,020 and 5,420 mg/kg) exceeded its SSSL (363 mg/kg) and background (1,579 mg/kg) in two samples

- Thallium (4.84 mg/kg) exceeded its SSSL (0.51 mg/kg) and background (3.43 mg/kg) in one sample.

Fourteen metals were detected at concentrations exceeding ESVs and background concentrations in one or more samples:

- Aluminum (20,700 mg/kg) exceeded its ESV (50 mg/kg) and background (16,306 mg/kg) in one sample

- Barium (217 and 226 mg/kg) exceeded its ESV (165 mg/kg) and background (124 mg/kg) in two samples

- Beryllium (1.15 to 2.9 mg/kg) exceeded its ESV (1.1 mg/kg) and background (0.8 mg/kg) in seven samples

- Cadmium (2.25 to 11.8 mg/kg) exceeded its ESV (1.6 mg/kg) and background (0.29 mg/kg) in nine samples

- Cobalt (21.5 to 38.4 mg/kg) exceeded its ESV (20 mg/kg) and background (15.2 mg/kg) in seven samples

- Copper (55.9 to 171 mg/kg) exceeded its ESV (40 mg/kg) and background (12.7 mg/kg) in six samples

- Iron (37,400 and 54,700 mg/kg) exceeded its ESV (200 mg/kg) and background (34,154 mg/kg) in two samples

- Manganese (3,020 and 5,420 mg/kg) exceeded its ESV (100 mg/kg) and background (1,579 mg/kg) in two samples

- Mercury (0.134 mg/kg) exceeded its ESV (0.1 mg/kg) and background (0.08 mg/kg) in one sample

- Nickel (31.7 to 57 mg/kg) exceeded its ESV (30 mg/kg) and background (10.3 mg/kg) in five samples

- Selenium (1.09 to 4.14 mg/kg) exceeded its ESV (0.81 mg/kg) and background (0.48 mg/kg) in nine samples

- Copper (55.9 to 171 mg/kg) exceeded its ESV (40 mg/kg) and background (12.7 mg/kg) in six samples

- Thallium (4.84 mg/kg) exceeded its ESV (1 mg/kg) and background (3.43 mg/kg) in one sample

- Zinc (72.8 to 132 mg/kg) exceeded its ESV (50 mg/kg) and background (40.6 mg/kg) in seven samples.

Of particular note for the metals listed above are copper and zinc, both of which are known constituents of small arms ammunition (ITRC, 2003). Nickel may also be a site-related metal due to its historical use in bullet jacketing in older military ammunition. Antimony is also a known constituent of small arms ammunition; however, this metal was not detected above analytical method detection limits in any of the confirmation samples. It is noted that the method detection limits for antimony were below the various screening criteria.

5.0 Correlation of XRF and Laboratory Lead Data

In response to recent Alabama Department of Environmental Management comments on several FTMC remedial investigation reports, Shaw prepared a technical memorandum discussing the correlation between XRF data and associated laboratory confirmation sample data for lead generated base-wide at FTMC (Appendix C). The assessment, which examined relative percent difference and used various statistical comparison tests, concluded that the XRF and laboratory confirmation data for lead generally show good correlation with one another, particularly in the lower end of the concentration range around 1,000 mg/kg or less. As shown in Table 1, the lead data collected during the OA-03 investigation follow this same trend with generally good correlation between the XRF data and the confirmation sample data, although the XRF results tended to be somewhat lower than the laboratory results.

6.0 Summary and Conclusions

Shaw completed XRF and confirmation soil sampling at OA-03, Former Pistol Range to determine whether historical range activities have resulted in contamination at this site. The

contaminants of potential concern were metals, particularly lead, associated with small arms ammunition based on this site's indicated use as a pistol range. Surface soil samples from 44 locations were analyzed for lead using XRF at OA-03. Twenty percent of the XRF-analyzed samples were sent to an offsite laboratory for confirmation metals analysis using EPA SW-846 methods.

Lead, the primary contaminant of concern, was detected at concentrations ranging from below the background level (40 mg/kg) to greater than 1,100 mg/kg at this site. The highest concentration of lead detected exceeded both the residential and industrial SSSLs developed for FTMC. The highest lead concentrations (up to 1,170 mg/kg) were present in samples collected in the hillside east of Ruskin Avenue, particularly in the southeastern area of the site. Several other metals, particularly cadmium, copper, nickel, and zinc, were also detected at elevated concentrations in the confirmation samples.

Based on the results of the investigation, historical range activities at OA-03 have resulted in contamination of surface soil with lead and other ammunition-related metals (e.g., copper, zinc, nickel) and possibly other metals (e.g., cadmium) not known to be associated with small-arms use. It is recommended that additional investigation be performed to determine the full horizontal and vertical extent of contamination at this site.

7.0 References

Environmental Science and Engineering, Inc., 1998, ***Environmental Baseline Survey, Fort McClellan, Alabama***, Final, January.

Interstate Technology and Regulatory Council (ITRC), 2003, ***Characterization and Remediation of Soils at Closed Small Arms Firing Ranges***, prepared by the Interstate Technology and Regulatory Council Small Arms Firing Range Team, January.

IT Corporation (IT), 2002, ***Installation-Wide Sampling and Analysis Plan, Fort McClellan, Calhoun County, Alabama***, Draft, Revision 3, February.

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

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

Shaw Environmental, Inc. (Shaw), 2007, ***XRF Soil Sampling at OA-03, Former Pistol Range,*** letter work plan, December 20.

U.S. Army Corps of Engineers (USACE), 2001, ***Requirements for the Preparation of Sampling and Analysis Plans,*** EM 200-1-3, February.

U.S. Army Corps of Engineers, 1999, ***Archives Search Report, Conclusions and Recommendations, Fort McClellan, Anniston, Alabama***, July.

At your request, I have distributed copies of this letter report as indicated below. If you have any questions, or need further information, please contact me at (865) 694-7361.

Sincerely,

Stephen G. Moran

Stephen G. Moran, P.G.
Project Manager

Enclosure

Distribution: Lisa Holstein, U.S. Army TF (4 copies; 2 CDs)
Brandi Little, ADEM (2 copies; 1 CD)
Doyle Brittain, EPA Region 4 (1 copy; 1 CD)
Miki Schneider, JPA (1 copy)
Michelle Beekman, Matrix Environmental (1 copy)

TABLES

Table 1

XRF and Confirmation Sample Data for Lead
OA-03, Former Pistol Range
Fort McClellan, Alabama

Sample Location	Sample Date	Sample Time	XRF Lead Result (mg/kg)	Lab Lead Result (mg/kg)	RPD	Notes
XRF01	3-Jan-08	11:45:53	44	NA	NA	
XRF02	3-Jan-08	11:48:39	29	NA	NA	
XRF03	2-Jan-08	16:14:07	32	NA	NA	
XRF04	2-Jan-08	16:26:11	30	NA	NA	
XRF05	2-Jan-08	16:30:02	33	NA	NA	
XRF06	2-Jan-08	16:33:17	22	NA	NA	
XRF07	2-Jan-08	16:36:34	27	NA	NA	
XRF08	2-Jan-08	16:39:04	23	NA	NA	
XRF09	2-Jan-08	16:41:29	19	NA	NA	
XRF10	2-Jan-08	16:43:59	21	NA	NA	
XRF11	2-Jan-08	16:46:14	31	NA	NA	
XRF12	3-Jan-08	11:51:08	41	NA	NA	
XRF13	3-Jan-08	11:53:28	33	NA	NA	
XRF14	3-Jan-08	11:55:48	16	NA	NA	
XRF15	3-Jan-08	11:58:09	39	NA	NA	
XRF16	3-Jan-08	12:00:14	34	NA	NA	
XRF17	2-Jan-08	16:48:20	33	NA	NA	
XRF18	2-Jan-08	16:50:48	16	NA	NA	
XRF19	2-Jan-08	16:56:35	20	NA	NA	
XRF20	2-Jan-08	16:58:51	18	NA	NA	
XRF21	2-Jan-08	17:01:19	63	NA	NA	East of Ruskin Ave.
XRF22	2-Jan-08	17:03:42	30	NA	NA	
XRF23	2-Jan-08	17:05:57	273	281	3%	East of Ruskin Ave., split with EMAX
XRF24	2-Jan-08	17:08:29	21	NA	NA	
XRF25	3-Jan-08	12:02:50	23	NA	NA	
XRF26	3-Jan-08	14:30:09	40	NA	NA	
XRF27	3-Jan-08	12:04:58	39	NA	NA	
XRF28	3-Jan-08	12:07:28	30	NA	NA	
XRF29	3-Jan-08	12:09:31	30	NA	NA	
XRF30	3-Jan-08	12:16:57	69	NA	NA	
XRF31	3-Jan-08	12:19:29	44	NA	NA	East of Ruskin Ave.
XRF32	3-Jan-08	12:22:00	33	NA	NA	East of Ruskin Ave.
XRF33	3-Jan-08	12:26:28	494	359	32%	East of Ruskin Ave., split with EMAX
XRF34	3-Jan-08	12:29:09	142	157	10%	East of Ruskin Ave., split with EMAX
XRF35	3-Jan-08	12:31:19	93	139	40%	East of Ruskin Ave., split with EMAX
XRF36	3-Jan-08	12:33:47	557	295	62%	East of Ruskin Ave., split with EMAX
XRF37	3-Jan-08	12:36:17	33	NA	NA	
XRF38	3-Jan-08	12:38:32	37	NA	NA	
XRF39	3-Jan-08	12:41:04	19	NA	NA	
XRF40	3-Jan-08	12:43:35	25	NA	NA	East of Ruskin Ave.
XRF41	3-Jan-08	14:20:10	228	342	40%	East of Ruskin Ave., split with EMAX
XRF42	3-Jan-08	14:22:45	891	1170	27%	East of Ruskin Ave., found 1 bullet in sample, split with EMAX
XRF43	3-Jan-08	14:24:48	68	107	45%	East of Ruskin Ave., split with EMAX
XRF44	3-Jan-08	14:27:43	87	119	31%	East of Ruskin Ave., split with EMAX

Sample was split with EMAX for TAL Metals analaysis
- milligrams per kilogram.
NA - not applicable.
RPD - Relative percent difference

Table 2

Confirmation Sample Results
OA-03, Former Pistol Range
Fort McClellan, Alabama

Sample Location					OA3-XRF023					OA3-XRF033					OA3-XRF034				
Sample Number					AF009					AF004					AF005				
Sample Date					2-Jan-08					3-Jan-08					3-Jan-08				
Sample Depth					0- 0.5					0- 0.5					0- 0.5				
Parameter	Units	BKG[a]	SSSL[b]	ESV[b]	Result	VQ	>BKG	>SSSL	>ESV	Result	VQ	>BKG	>SSSL	>ESV	Result	VQ	>BKG	>SSSL	>ESV
METALS																			
Aluminum	mg/kg	1.63E+04	7.80E+03	5.00E+01	1.09E+04			YES	YES	1.09E+04			YES	YES	8.69E+03			YES	YES
Arsenic	mg/kg	1.37E+01	4.26E-01	1.00E+01	6.94E+00			YES		8.23E+00			YES		4.02E+00			YES	
Barium	mg/kg	1.24E+02	5.47E+02	1.65E+02	6.47E+01	J				9.22E+01	J				8.37E+01	J			
Beryllium	mg/kg	8.00E-01	9.60E+00	1.10E+00	1.15E+00	J	YES		YES	1.41E+00		YES		YES	8.86E-01	J	YES		
Cadmium	mg/kg	2.90E-01	6.25E+00	1.60E+00	5.92E+00		YES		YES	7.57E+00		YES	YES	YES	2.25E+00		YES		YES
Calcium	mg/kg	1.72E+03	NA	NA	2.23E+02					6.53E+02					1.48E+02				
Chromium	mg/kg	3.70E+01	2.32E+01	4.00E-01	1.80E+01				YES	1.90E+01				YES	1.25E+01				YES
Cobalt	mg/kg	1.52E+01	4.68E+02	2.00E+01	2.61E+01		YES		YES	3.47E+01		YES		YES	3.29E+01		YES		YES
Copper	mg/kg	1.27E+01	3.13E+02	4.00E+01	1.05E+02		YES		YES	1.01E+02		YES		YES	3.42E+01		YES		
Iron	mg/kg	3.42E+04	2.34E+03	2.00E+02	3.10E+04			YES	YES	3.74E+04		YES	YES	YES	1.22E+04			YES	YES
Lead	mg/kg	4.01E+01	4.00E+02	5.00E+01	2.81E+02	J	YES		YES	3.59E+02	J	YES		YES	1.57E+02	J	YES		YES
Magnesium	mg/kg	1.03E+03	NA	4.40E+05	1.15E+03		YES			1.35E+03		YES			4.48E+02				
Manganese	mg/kg	1.58E+03	3.63E+02	1.00E+02	6.06E+02			YES	YES	8.66E+02			YES	YES	5.42E+02			YES	YES
Mercury	mg/kg	8.00E-02	2.33E+00	1.00E-01	5.35E-02	J				7.43E-02	J				4.77E-02	J			
Nickel	mg/kg	1.03E+01	1.54E+02	3.00E+01	2.45E+01		YES			3.17E+01		YES		YES	9.70E+00				
Potassium	mg/kg	8.00E+02	NA	NA	1.19E+03		YES			1.46E+03		YES			4.38E+02	J			
Selenium	mg/kg	4.80E-01	3.91E+01	8.10E-01	2.59E+00		YES		YES	2.81E+00		YES		YES	1.12E+00	J	YES		YES
Sodium	mg/kg	6.34E+02	NA	NA	3.53E+01	J				3.34E+01	J				2.30E+01	J			
Thallium	mg/kg	3.43E+00	5.08E-01	1.00E+00	ND					8.56E-01	J		YES		ND				
Vanadium	mg/kg	5.88E+01	5.31E+01	2.00E+00	3.37E+01				YES	3.83E+01				YES	2.01E+01				YES
Zinc	mg/kg	4.06E+01	2.34E+03	5.00E+01	8.45E+01	J	YES		YES	1.00E+02	J	YES		YES	3.35E+01	J			

Table 2

Confirmation Sample Results
OA-03, Former Pistol Range
Fort McClellan, Alabama

Sample Location					OA3-XRF035					OA3-XRF036					OA3-XRF041				
Sample Number					AF007					AF003					AF002				
Sample Date					3-Jan-08					3-Jan-08					3-Jan-08				
Sample Depth					0- 0.5					0- 0.5					0- 0.5				
Parameter	Units	BKG[a]	SSSL[b]	ESV[b]	Result	VQ	>BKG	>SSSL	>ESV	Result	VQ	>BKG	>SSSL	>ESV	Result	VQ	>BKG	>SSSL	>ESV
METALS																			
Aluminum	mg/kg	1.63E+04	7.80E+03	5.00E+01	1.01E+04			YES	YES	2.07E+04		YES	YES	YES	1.47E+04			YES	YES
Arsenic	mg/kg	1.37E+01	4.26E-01	1.00E+01	3.56E+00			YES		8.04E+00			YES		1.15E+01			YES	YES
Barium	mg/kg	1.24E+02	5.47E+02	1.65E+02	1.09E+02	J				2.17E+02	J	YES		YES	7.75E+01	J			
Beryllium	mg/kg	8.00E-01	9.60E+00	1.10E+00	1.19E+00	J	YES		YES	1.69E+00		YES		YES	1.58E+00		YES		YES
Cadmium	mg/kg	2.90E-01	6.25E+00	1.60E+00	2.62E+00		YES		YES	5.12E+00		YES		YES	1.18E+01		YES	YES	YES
Calcium	mg/kg	1.72E+03	NA	NA	9.18E+02					2.11E+03		YES			4.81E+02				
Chromium	mg/kg	3.70E+01	2.32E+01	4.00E-01	1.19E+01				YES	2.20E+01				YES	2.48E+01			YES	YES
Cobalt	mg/kg	1.52E+01	4.68E+02	2.00E+01	1.82E+01		YES			2.26E+01		YES		YES	2.15E+01		YES		YES
Copper	mg/kg	1.27E+01	3.13E+02	4.00E+01	6.87E+01		YES		YES	3.18E+01		YES			1.32E+02		YES		YES
Iron	mg/kg	3.42E+04	2.34E+03	2.00E+02	1.33E+04			YES	YES	2.58E+04			YES	YES	5.47E+04		YES	YES	YES
Lead	mg/kg	4.01E+01	4.00E+02	5.00E+01	1.39E+02	J	YES		YES	2.95E+02	J	YES		YES	3.42E+02	J	YES		YES
Magnesium	mg/kg	1.03E+03	NA	4.40E+05	9.39E+02					1.20E+03		YES			2.63E+03		YES		
Manganese	mg/kg	1.58E+03	3.63E+02	1.00E+02	9.68E+02			YES	YES	3.02E+03		YES	YES	YES	7.48E+02			YES	YES
Mercury	mg/kg	8.00E-02	2.33E+00	1.00E-01	8.55E-02	J	YES			7.78E-02	J				1.34E-01		YES		YES
Nickel	mg/kg	1.03E+01	1.54E+02	3.00E+01	3.41E+01		YES		YES	2.65E+01		YES			4.06E+01		YES		YES
Potassium	mg/kg	8.00E+02	NA	NA	6.74E+02					1.12E+03		YES			1.16E+03		YES		
Selenium	mg/kg	4.80E-01	3.91E+01	8.10E-01	1.09E+00	J	YES		YES	1.54E+00		YES		YES	4.14E+00		YES		YES
Sodium	mg/kg	6.34E+02	NA	NA	4.28E+01	J				3.85E+01	J				3.86E+01	J			
Thallium	mg/kg	3.43E+00	5.08E-01	1.00E+00	8.55E-01	J		YES		2.38E+00	J		YES	YES	7.64E-01	J		YES	
Vanadium	mg/kg	5.88E+01	5.31E+01	2.00E+00	2.17E+01				YES	4.32E+01				YES	4.46E+01				YES
Zinc	mg/kg	4.06E+01	2.34E+03	5.00E+01	7.28E+01	J	YES		YES	7.93E+01	J	YES		YES	1.32E+02	J	YES		YES

Table 2

Confirmation Sample Results
OA-03, Former Pistol Range
Fort McClellan, Alabama

Sample Location					OA3-XRF042					OA3-XRF043					OA3-XRF044				
Sample Number					AF001					AF008					AF006				
Sample Date					3-Jan-08					3-Jan-08					3-Jan-08				
Sample Depth					0- 0.5					0- 0.5					0- 0.5				
Parameter	Units	BKG[a]	SSSL[b]	ESV[b]	Result	VQ	>BKG	>SSSL	>ESV	Result	VQ	>BKG	>SSSL	>ESV	Result	VQ	>BKG	>SSSL	>ESV
METALS																			
Aluminum	mg/kg	1.63E+04	7.80E+03	5.00E+01	1.32E+04			YES	YES	7.37E+03				YES	1.62E+04			YES	YES
Arsenic	mg/kg	1.37E+01	4.26E-01	1.00E+01	7.44E+00			YES		5.20E+00			YES		8.58E+00			YES	
Barium	mg/kg	1.24E+02	5.47E+02	1.65E+02	1.02E+02	J				5.91E+01	J				2.26E+02	J	YES		YES
Beryllium	mg/kg	8.00E-01	9.60E+00	1.10E+00	1.97E+00		YES		YES	4.85E-01	J				2.90E+00		YES		YES
Cadmium	mg/kg	2.90E-01	6.25E+00	1.60E+00	6.43E+00		YES	YES	YES	4.12E+00		YES		YES	6.59E+00		YES	YES	YES
Calcium	mg/kg	1.72E+03	NA	NA	4.71E+02					3.22E+02					8.14E+02				
Chromium	mg/kg	3.70E+01	2.32E+01	4.00E-01	1.59E+01				YES	1.82E+01				YES	2.50E+01			YES	YES
Cobalt	mg/kg	1.52E+01	4.68E+02	2.00E+01	2.81E+01		YES		YES	5.99E+00					3.84E+01		YES		YES
Copper	mg/kg	1.27E+01	3.13E+02	4.00E+01	1.71E+02		YES		YES	1.22E+01					5.59E+01		YES		YES
Iron	mg/kg	3.42E+04	2.34E+03	2.00E+02	3.17E+04			YES	YES	2.27E+04			YES	YES	3.13E+04			YES	YES
Lead	mg/kg	4.01E+01	4.00E+02	5.00E+01	1.17E+03	J	YES	YES	YES	1.07E+02	J	YES		YES	1.19E+02	J	YES		YES
Magnesium	mg/kg	1.03E+03	NA	4.40E+05	1.18E+03		YES			3.76E+02					1.31E+03		YES		
Manganese	mg/kg	1.58E+03	3.63E+02	1.00E+02	1.00E+03			YES	YES	1.08E+02				YES	5.42E+03		YES	YES	YES
Mercury	mg/kg	8.00E-02	2.33E+00	1.00E-01	9.50E-02	J	YES			4.51E-02	J				6.85E-02	J			
Nickel	mg/kg	1.03E+01	1.54E+02	3.00E+01	3.40E+01		YES		YES	9.93E+00					5.70E+01		YES		YES
Potassium	mg/kg	8.00E+02	NA	NA	1.53E+03		YES			4.73E+02	J				9.76E+02		YES		
Selenium	mg/kg	4.80E-01	3.91E+01	8.10E-01	2.38E+00		YES		YES	1.97E+00		YES		YES	1.60E+00		YES		YES
Sodium	mg/kg	6.34E+02	NA	NA	3.67E+01	J				3.30E+01	J				3.56E+01	J			
Thallium	mg/kg	3.43E+00	5.08E-01	1.00E+00	7.20E-01	J		YES		ND					4.84E+00		YES	YES	YES
Vanadium	mg/kg	5.88E+01	5.31E+01	2.00E+00	3.15E+01				YES	2.61E+01				YES	3.76E+01				YES
Zinc	mg/kg	4.06E+01	2.34E+03	5.00E+01	1.11E+02	J	YES		YES	3.21E+01	J				1.23E+02	J	YES		YES

Analyses performed using U.S. Environmental Protection Agency (EPA) SW-846 analytical methods.

[a] BKG - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in SAIC, 1998, *Final Background Metals Survey Report, Fort McClellan, Alabama*, July.

[b] Residential human health site-specific screening level (SSSL) and ecological screening value (ESV) as given in IT, 2000, *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama*, July.

J - Compound was positively identified; reported value is an estimated concentration.

mg/kg - Milligrams per kilogram.

NA - Not available.

ND - Not detected.

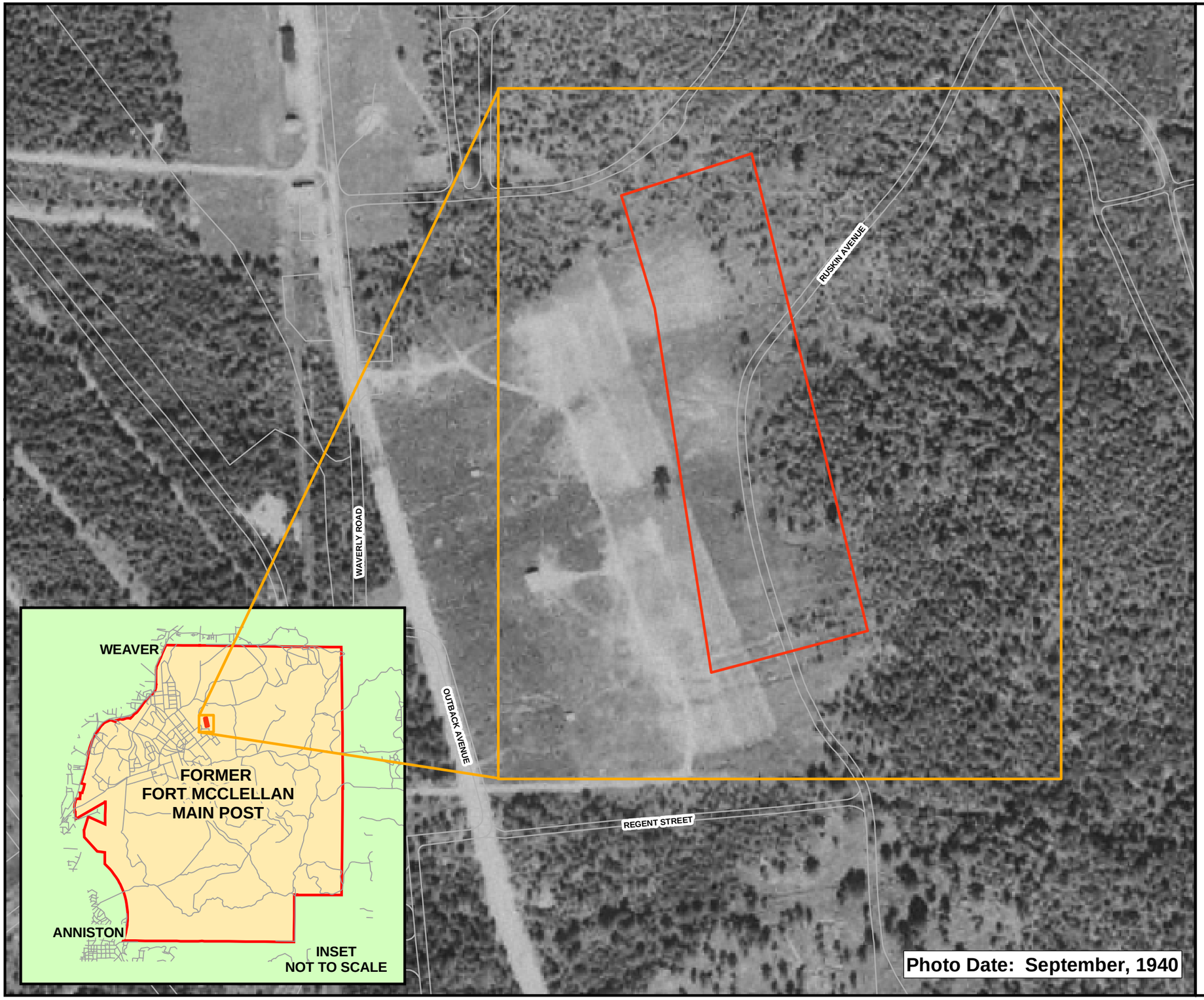
VQ - Data validation qualifier.

FIGURES

Figure 1

Site Location Map

OA-03 (Pistol Range)
Fort McClellan, Alabama



Legend

- OA-03 Boundary
- Current Roads

Note: This map employs uncontrolled aerial photographs. The resulting distortions affect the spatial accuracy of the photographs.

200 0 200 Feet

N

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Figure 2

Sample Locations and Lead-in-Surface Soil Isocontour Map

OA-03 (Pistol Range)
Fort McClellan, Alabama

Legend

- XRF Sample Location
- XRF Sample Location with Confirmatory Laboratory Analysis (lab result shown in parenthesis)
- OA-03 Boundary
- Current Roads
- XRF35 (93 mg/kg) — Sample Location Number with Lead Concentration Shown in Parentheses

Lead Isocontours (mg/kg)

- 50 - 199
- 200 - 399
- 400 - 879
- > 880

Note: This map employs uncontrolled aerial photographs. The resulting distortions affect the spatial accuracy of the photographs.

150 0 150 Feet

NAD83 State Plane Coordinates

N

Shaw Environmental, Inc.

U.S. Army Corps of Engineers Mobile District

Contract No. DACA21-96-D-0018

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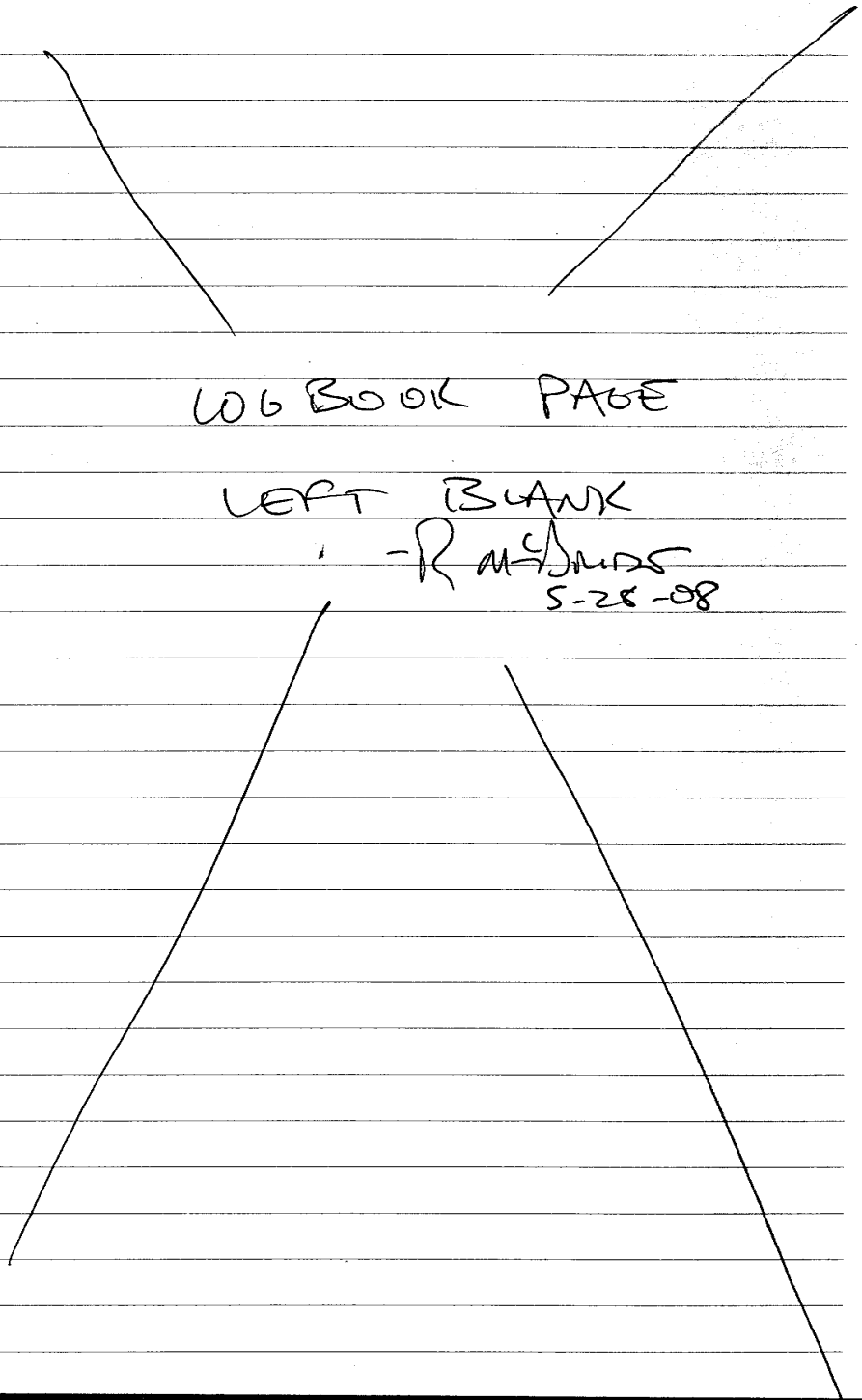
APPENDIX A

FIELD DATA FORMS

XRF FIELD DATA LOGBOOK



(WED)
01-02-08 FT. MCCLELLAN OA-03 PISTOL RANGE INVEST.

1300 START ONSITE WITH GPS DATA ENTRY AND PREP.

1400 ARRIVE ONSITE. BEGIN SAMPLE COLLECTION.

1530 FINISH COLLECTING SAMPLES AT LOC # 017. TOTAL 17 TOTAL COLLECTED. LEAVE SITE FOR OFFICE.

1600 SET UP XRF. PERF. CALIB. CHECK.

1715 BEGIN XRF ANALYSIS.

READ #	ID	LEAD RESULT	STD-	
5	003	32	3	
6	004	30	3	
7	005	33	3	
8	006	22	3	
9	007	27	3	
10	008	23	3	
11	009	19	3	
12	010	21	2	
13	011	31	3	
14	017	33	3	
15	018	16	2	13% RPD
16	018-DUP	14	2	
17	019	20	3	
18	020	18	3	
19	021	63	3	
20	022	30	3	
21	023	273	6	
22	024	21	2	16% RPD
23	023-DUP	321	7	

(WED)
1-2-08 FT. McCLELLAN OA-03 PISTOL RANGE INVEST.

1930 FINISH ANALYSIS. STORE XRF DATA.
SECURE SAMPLES.
LEAVE SITE FOR DAY.

WEATHER: SUNNY COLD
TEMP 25-30°F
NO RAIN, WIND.

1-2-08

(THU)
01-03-08 FT. McCLELLAN OA-03 PISTOL RANGE INVEST.

0800 ARRIVE ONSITE ATTEND TAILGATE SAFETY MTG.
PACK UP EQUIPMENT + SUPPLIES. LOAD OFF-LOAD MW1-3 SITE FOR SITE.
0830 ARRIVE ONSITE. LOOK UP GPS LOCATIONS.
0840 BEGIN SAMPLE COLLECTION OF LOCATIONS 025 AND NORTH TO 030.
0950 COMPLETE SAMPLE COLLECTION IN NORTHERN PARCEL. BEGIN DEL TO NORTH + EAST OF 023.
1115 COMPLETE COLLECTION OF 10 OXNA SAMPLES. LOAD SITE FOR OFFICE.
1130 RETURN TO OFFICE UNLOAD EQUIPMENT + SAMPLES.
1145 LEAVE OFFICE FOR LUNCH.
1220 RETURN TO OFFICE, INVENTORY SAMPLES. SETUP + CALIBRATE XRF.
1250 CALIBRATION COMPLETE - BEGIN SAMPLE ANALYSIS.

XRF READ #	LOCATION	Pb CONC	STD.
6	001	44	3
7	002	29	3
8	012	41	3
9	013	33	3
10	014	100 MW1-3	3
11	015	39	3
12	016	34	3
13	025	23	3
14	027	39	3
15	028	30	3

(THM) 1-3-08 FT. MCCLELLAN OA-03 RANGE INVEST.

READ #	LOCATION	Pb CONC	STD.	
16	029	30	3	} 40% RPD
17	029-DUP	20	3	
18	030	69	4	
19	031	44	3	
20	032	33	3	
21	033	494	8	
22	034	142	4	
23	035	93	4	
24	036	557	9	} 80% RPD
25	037	33	3	
26	038	37	3	
27	039	19	3	
28	040	25	3	
29	036-DUP	2480	5	

DETERMINE 5 MORE LOCATIONS REQUIRED FURTHER EAST OF 36, 35, 34, 33 AND SOUTH OF 33.

1420 RETURN TO OA-03. GATHER EQUIPMENT.

1500 COLLECT 4 ADDITIONAL SAMPLES 041-044. LEAVE SITE FOR OFFICE.

1515 RETURN TO OFFICE. DOWNLOAD GPS DATA. CHECK XRF. BEGIN SAMPLE ANALYSIS.

RUN 1-3					
30	35	041	228	5	
31	36	042	891	11	*FOUND 1 BULLET IN SAMPLE
32	37	043	68	3	
33	38	044	87	4	
34	39	026	40	3	

(THM) 1-3-08 FT MCCLELLAN OA-03 RANGE INVEST

NEW SAMPLE POINTS NORTH + EAST OF 023:

GPS DATA

LOCATION	LAT	LONG
OA-031	N33.72563	W85.77511
-032	N33.72505	W85.77507
033	N 33.72466	W085.77454
034	N33.72518	W85.77477
035	N33.72574	W85.77483
036	N33.72591	W85.77483
037	N33.72630	W85.77500
038	N33.72654	W85.77496
039	N33.72667	W85.77457
040	N33.72607	W85.77468
DRUM	N33.72475	W85.77483

SUPPLEMENTAL POINTS:

041	N33.72441	W85.77462
042	N33.72475	W85.77420
043	N33.72525	W85.77443
044	N33.72577	W85.77442

1530 DISCUSS RESULTS WITH MOY. DECIDE TO SPLIT 20% SAMPLES W/ EMAX (9 TOTAL).

COLL DATE 1-3-08	LOCATIONS	SPLIT ANLS	
14:35	042 - 891 ppm	14:50	044 - 87 ppm
14:30	041 - 228 ppm	10:39	035 - 93 ppm
10:43	036 - 557 ppm	12:43	043 - 68 ppm
10:20	033 - 494 ppm		023 - 273 ppm
10:23	034 - 142 ppm		(01-02-14:55) COLL DATE/TIME

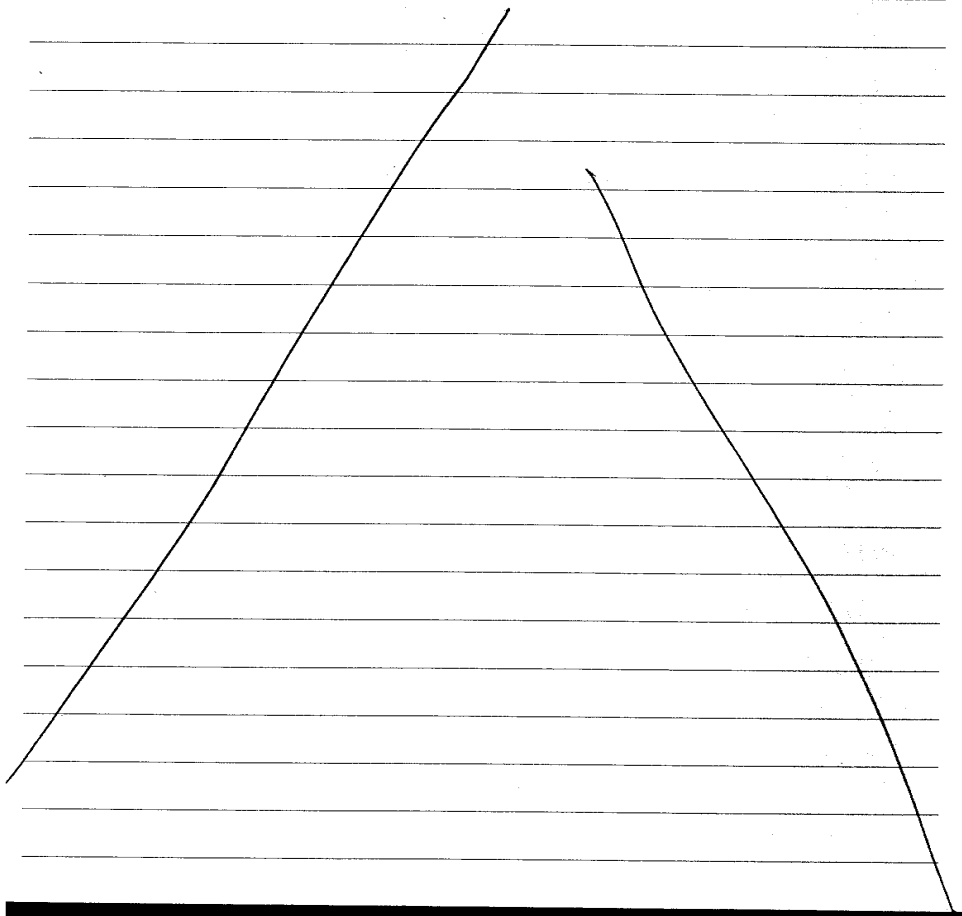
NO ADDITONAL LOG BOOK

NOTES RECORDED FOR

JAN 03, 2008.

- R McBride

5-28-08



SAMPLE COLLECTION LOGS AND ANALYSIS REQUEST/CHAIN-OF-CUSTODY FORMS FOR CONFIRMATION SAMPLES

Shaw
Shaw Environmental & Infrastructure, Inc.

Sample Collection Log

Project: 796887 Fort McClellan, SAD TERC **Manager:** Moran, Steve G

RFA/COC Number: EMAX-OA03-001

Site: Fmr Pistol Range near T-38 *Location Code:* OA-03

Grid Samples:

Location	Number	Date	Time	Method
XRF042	AF001	1/3/2008	14:35	Surface Soil - SS Spoon
XRF041	AF002	1/3/2008	14:30	Surface Soil - SS Spoon
XRF036	AF003	1/3/2008	10:43	Surface Soil - SS Spoon
XRF033	AF004	1/3/2008	10:20	Surface Soil - SS Spoon
XRF033-MS/D	AF004-MS/D	1/3/2008	10:20	Surface Soil - SS Spoon
XRF034	AF005	1/3/2008	10:23	Surface Soil - SS Spoon
XRF044	AF006	1/3/2008	14:50	Surface Soil - SS Spoon
XRF035	AF007	1/3/2008	10:30	Surface Soil - SS Spoon
XRF043	AF008	1/3/2008	12:43	Surface Soil - SS Spoon
XRF023	AF009	1/2/2008	14:55	Surface Soil - SS Spoon

Analytical Suite	Qty	Size	Units	Type	TCLP (Y/N)
TAL Metals	1	4	oz	CWM	N

Site Sketch:

(See Attached Drawing)

Comments:

Logged BY/Date: 1-3-08 Reviewed BY/Date: 5/28/08

SPLIT SAMPLED W/ LAB
ARE CIRCLED — R. McSwain 1-3-08

Figure 1

Site Map

OA-03 (Pistol Range)
Fort McClellan, Alabama

Legend

- Proposed XRF Sample Location
- OA-03 Boundary
- Current Roads

LOCATION	NORTHING	EASTING
1	1173622.204	673407.958
2	1173494.301	673453.482
3	1173355.558	673520.686
4	1173218.984	673570.546
5	1173067.234	673620.407
6	1172908.981	673681.107
7	1172781.078	673728.799
8	1172882.967	673778.660
9	1173036.884	673722.296
10	1173186.466	673657.260
11	1173318.705	673613.903
12	1173468.286	673557.539
13	1173602.693	673492.504
14	1173704.582	673544.532
15	1173559.336	673603.064
16	1173433.601	673652.925
17	1173270.603	673711.211
18	1173155.912	673764.630
19	1173006.330	673821.403
20	1172841.573	673886.030
21	1172900.310	673969.431
22	1173094.884	673853.430
23	1173147.731	673932.045
24	1173184.298	673841.527
25	1173401.083	673748.310
26	1173479.126	673815.513
27	1173502.972	673724.464
28	1173652.554	673681.107
29	1173726.046	673745.568
30	1173731.724	673659.163

150 0 150 Feet

NAD83 State Plane Coordinates

N

Shaw Shaw Environmental, Inc.

U.S. Army Corps of Engineers Mobile District

Contract No. DACA21-96-D-0018

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Shaw
Shaw Environmental & Infrastructure, Inc.

SH_0422

ANALYSIS REQUEST AND CHAIN-OF-CUSTODY RECORD

08A032

REFERENCE COC NO.: EMAX-OA03-001

PAGE 1 OF 2

Project Name/No: Fort McClellan OA-03 Pistol Range/796887
Sample Team Member: R. McBride
Profit Center:
Project Manager: Moran, Steve
Purchase Order No.:
Required Report Date: **Normal**

Sample Shipment Date: **01-04-08**
Laboratory Destination: EMAX
Laboratory Contact: Molly Nguen
Project Contact/Phone: R. McBride 865/766-9292
Carrier Waybill No.: UPS 1Z 666 539 13 9215 4389

Bill To: Shaw Environmental
Accounts Payable
312 Directors Drive
Knoxville, TN 37923

Report To: Shaw Environmental
Randy McBride
312 Directors Drive
Knoxville, TN 37923

	Sample Number	Sample Type/ Description	Date/Time Collected	Container Type	Sample Volume	Pre-servative	Requested Testing Program	Condition on Receipt	Disposal Record
1	AF001	OA3-XRF042-AF001-REG	1/3/2008 14:35	1 x 4oz CWM	1 x 4 oz	None	TAL Metals by 6010B		
2	AF002	OA3-XRF041-AF002-REG	1/3/2008 14:30	1 x 4oz CWM	1 x 4 oz	None	TAL Metals by 6010B		
3	AF003	OA3-XRF036-AF003-REG	1/3/2008 10:43	1 x 4oz CWM	1 x 4 oz	None	TAL Metals by 6010B		
4	AF004	OA3-XRF033-AF004-REG	1/3/2008 10:20	1 x 4oz CWM	1 x 4 oz	None	TAL Metals by 6010B		
	AF004-MS/D	OA3-XRF033-AF004-MS/D	1/3/2008 10:20	1 x 4oz CWM	1 x 4 oz	None	TAL Metals by 6010B		
5	AF005	OA3-XRF034-AF005-REG	1/3/2008 10:23	1 x 4oz CWM	1 x 4 oz	None	TAL Metals by 6010B		
6	AF006	OA3-XRF044-AF006-REG	1/3/2008 14:50	1 x 4oz CWM	1 x 4 oz	None	TAL Metals by 6010B		
7	AF007	OA3-XRF035-AF007-REG	1/3/2008 10:30	1 x 4oz CWM	1 x 4 oz	None	TAL Metals by 6010B		

Special Instructions: R.T.

Possible Hazard Identification: Use caution when handling, possible lead hazard.
Non-haz: ____ Flammable: ____ Poison B: ____ Unknown: X

Sample Disposal:
Return to Client: ____ Disposal by Lab: X Archive: ____

Turnaround Time:
Normal: X Rush: ____

Level of QC Required:
I. ____ II. ____ III. ____ Project Specific: X

1. Relinquished by: R.L. McBride SHAW ENVIRONMENTAL Date: 1-4-08 Time: 1530
1. Received by: UPS Date: ____ Time: ____
2. Relinquished by: UPS Date: 01/07/08 Time: 10 50
2. Received by: Carol Di Puglia Date: 01/07/08 Time: 1050
3. Relinquished by: Date: ____ Time: ____
3. Received by: Date: ____ Time: ____

Comments: If samples not received in good condition contact Randy McBride at 865/766-9292. **EMAIL RESULTS to randy.mcbride@shawgrp.com**

Reference COC Number: **EMAX-OA03-001**

Shaw
Shaw Environmental & Infrastructure, Inc.

ANALYSIS REQUEST AND CHAIN-OF-CUSTODY RECORD (Cont.)

Project Name/No.: Fort McClellan OA-03 Pistol Range/796887 Laboratory Destination: EMAX Sample Shipment Date: **01-04-08**

Sample Number	Sample Type/ Description	Date/Time Collected	Container Type	Sample Volume	Pre-servative	Requested Testing Program	Condition on Receipt	Disposal Record
AF008	OA3-XRF043-AF008-REG	1/3/2008 12:43	1 x 4oz CWM	1 x 4 oz	None	TAL Metals by 6010B		
AF009	OA3-XRF023-AF009-REG	1/2/2008 14:55	1 x 4oz CWM	1 x 4 oz	None	TAL Metals by 6010B		

Last Line of COC.

Revised

APPENDIX B

LABORATORY ANALYTICAL DATA FOR CONFIRMATION SAMPLES

Summary of Validated Surface and Depositional Soil Analytical Data
OA-03 Pistol Range
Fort McClellan, Alabama

Report Date: 06/02/08

User Test Group / Lab Method / Parameter	Units	Location Code:			Location Code:			Location Code:			Location Code:		
		Associated Site:			Associated Site:			Associated Site:			Associated Site:		
		Sample No:			Sample No:			Sample No:			Sample No:		
		Sample Date:			Sample Date:			Sample Date:			Sample Date:		
		Sample Depth:			Sample Depth:			Sample Depth:			Sample Depth:		
		OA3-XRF023			OA3-XRF033			OA3-XRF034			OA3-XRF035		
		OA-03			OA-03			OA-03			OA-03		
		AF009			AF004			AF005			AF007		
		02-JAN-08			03-JAN-08			03-JAN-08			03-JAN-08		
		0 - .5			0 - .5			0 - .5			0 - .5		
		Result	Qual	VQual	Result	Qual	VQual	Result	Qual	VQual	Result	Qual	VQual
METALS													
SW6010B													
Aluminum	mg/kg	10900			10900			8690			10100		
Antimony	mg/kg	12.1	U	UJ	12.4	U	UJ	12.8	U	UJ	13.4	U	UJ
Arsenic	mg/kg	6.94			8.23			4.02			3.56		
Barium	mg/kg	64.7		J	92.2		J	83.7		J	109		J
Beryllium	mg/kg	1.15	J	J	1.41			0.886	J	J	1.19	J	J
Cadmium	mg/kg	5.92			7.57			2.25			2.62		
Calcium	mg/kg	223			653			148			918		
Chromium	mg/kg	18.0			19.0			12.5			11.9		
Cobalt	mg/kg	26.1			34.7			32.9			18.2		
Copper	mg/kg	105			101			34.2			68.7		
Iron	mg/kg	31000			37400			12200			13300		
Lead	mg/kg	281		J	359		J	157		J	139		J
Magnesium	mg/kg	1150			1350			448			939		
Manganese	mg/kg	606			866			542			968		
Nickel	mg/kg	24.5			31.7			9.70			34.1		
Potassium	mg/kg	1190			1460			438	J	J	674		
Selenium	mg/kg	2.59			2.81			1.12	J	J	1.09	J	J
Silver	mg/kg	2.42	U	U	2.48	U	U	2.57	U	U	2.68	U	U
Sodium	mg/kg	35.3	J	J	33.4	J	J	23.0	J	J	42.8	J	J
Thallium	mg/kg	2.42	U	U	0.856	J	J	2.57	U	U	0.855	J	J
Vanadium	mg/kg	33.7			38.3			20.1			21.7		
Zinc	mg/kg	84.5		J	100		J	33.5		J	72.8		J
SW7471A													
Mercury	mg/kg	0.0535	J	J	0.0743	J	J	0.0477	J	J	0.0855	J	J

Summary of Validated Surface and Depositional Soil Analytical Data
OA-03 Pistol Range
Fort McClellan, Alabama

Report Date: 06/02/08

User Test Group / Lab Method / Parameter	Units	Location Code:											
		Associated Site:											
		Sample No:											
		Sample Date:											
		Sample Depth:											
		OA3-XRF036			OA3-XRF041			OA3-XRF042			OA3-XRF043		
		OA-03			OA-03			OA-03			OA-03		
		AF003			AF002			AF001			AF008		
		03-JAN-08			03-JAN-08			03-JAN-08			03-JAN-08		
		0 - .5			0 - .5			0 - .5			0 - .5		
		Result	Qual	VQual	Result	Qual	VQual	Result	Qual	VQual	Result	Qual	VQual
METALS													
SW6010B													
Aluminum	mg/kg	20700			14700			13200			7370		
Antimony	mg/kg	13.2	U	UJ	12.8	U	UJ	13.3	U	UJ	12.1	U	UJ
Arsenic	mg/kg	8.04			11.5			7.44			5.20		
Barium	mg/kg	217		J	77.5		J	102		J	59.1		J
Beryllium	mg/kg	1.69			1.58			1.97			0.485	J	J
Cadmium	mg/kg	5.12			11.8			6.43			4.12		
Calcium	mg/kg	2110			481			471			322		
Chromium	mg/kg	22.0			24.8			15.9			18.2		
Cobalt	mg/kg	22.6			21.5			28.1			5.99		
Copper	mg/kg	31.8			132			171			12.2		
Iron	mg/kg	25800			54700			31700			22700		
Lead	mg/kg	295		J	342		J	1170		J	107		J
Magnesium	mg/kg	1200			2630			1180			376		
Manganese	mg/kg	3020			748			1000			108		
Nickel	mg/kg	26.5			40.6			34.0			9.93		
Potassium	mg/kg	1120			1160			1530			473	J	J
Selenium	mg/kg	1.54			4.14			2.38			1.97		
Silver	mg/kg	2.65	U	U	2.57	U	U	2.66	U	U	2.42	U	U
Sodium	mg/kg	38.5	J	J	38.6	J	J	36.7	J	J	33.0	J	J
Thallium	mg/kg	2.38	J	J	0.764	J	J	0.720	J	J	2.42	U	U
Vanadium	mg/kg	43.2			44.6			31.5			26.1		
Zinc	mg/kg	79.3		J	132		J	111		J	32.1		J
SW7471A													
Mercury	mg/kg	0.0778	J	J	0.134			0.0950	J	J	0.0451	J	J

Summary of Validated Surface and Depositional Soil Analytical Data

OA-03 Pistol Range

Fort McClellan, Alabama

Location Code:	OA3-XRF044			
Associated Site:	OA-03			
Sample No:	AF006			
Sample Date:	03-JAN-08			
Sample Depth:	0 - .5			
User Test Group / Lab Method / Parameter	*Units*	*Result*	*Qual*	*VQual*
METALS				
SW6010B				
Aluminum	mg/kg	16200		
Antimony	mg/kg	12.6	U	UJ
Arsenic	mg/kg	8.58		
Barium	mg/kg	226		J
Beryllium	mg/kg	2.90		
Cadmium	mg/kg	6.59		
Calcium	mg/kg	814		
Chromium	mg/kg	25.0		
Cobalt	mg/kg	38.4		
Copper	mg/kg	55.9		
Iron	mg/kg	31300		
Lead	mg/kg	119		J
Magnesium	mg/kg	1310		
Manganese	mg/kg	5420		
Nickel	mg/kg	57.0		
Potassium	mg/kg	976		
Selenium	mg/kg	1.60		
Silver	mg/kg	2.51	U	U
Sodium	mg/kg	35.6	J	J
Thallium	mg/kg	4.84		
Vanadium	mg/kg	37.6		
Zinc	mg/kg	123		J
SW7471A				
Mercury	mg/kg	0.0685	J	J

LABORATORY DATA SHEETS

LABORATORIES, INC.
1835 W. 205th Street
Torrance, CA 90501
Tel: (310) 618-8889
Fax:(310) 618-0818

Date: 01-24-2008
EMAX Batch No.: 08A032

Attn: Tim Roth

Shaw E&I
312 Directors Dr.
Knoxville TN 37923-4799

Subject: Laboratory Report
Project: Fort McClellan

Enclosed is the Laboratory report for samples received on 01/07/08.
The data reported include :

Sample ID	Control #	Col Date	Matrix	Analysis
AF001	A032-01	01/03/08	SOIL	METALS TAL BY ICP MERCURY
AF002	A032-02	01/03/08	SOIL	METALS TAL BY ICP MERCURY
AF003	A032-03	01/03/08	SOIL	METALS TAL BY ICP MERCURY
AF004	A032-04	01/03/08	SOIL	METALS TAL BY ICP MERCURY
AF005	A032-05	01/03/08	SOIL	METALS TAL BY ICP MERCURY
AF006	A032-06	01/03/08	SOIL	METALS TAL BY ICP MERCURY
AF007	A032-07	01/03/08	SOIL	METALS TAL BY ICP MERCURY
AF009	A032-08	01/02/08	SOIL	METALS TAL BY ICP MERCURY
AF008	A032-09	01/03/08	SOIL	METALS TAL BY ICP MERCURY
AF004MS	A032-04M	01/03/08	SOIL	METALS TAL BY ICP

Sample ID	Control #	Col Date	Matrix	Analysis
				MERCURY
AF004MSD	A032-04S	01/03/08	SOIL	METALS TAL BY ICP
				MERCURY

The results are summarized on the following pages.

Please feel free to call if you have any questions concerning these results.

Sincerely yours,

Caspar J. Pang
Acting Laboratory Director

EMAX certifies that the results included in this report meet all NELAC requirements unless noted in the Case Narrative.

METHOD 3050B/6010B
METALS BY ICP

Client : SHAW E&I	Date Collected: 01/03/08 14:35
Project : FORT MCCLELLAN	Date Received: 01/07/08
SDG NO. : 08A032	Date Extracted: 01/10/08 10:35
Sample ID: AF001	Date Analyzed: 01/15/08 18:24
Lab Samp ID: A032-01	Dilution Factor: 1
Lab File ID: ID8A013019	Matrix : SOIL
Ext Btch ID: IPA011S	% Moisture : 24.7
Calib. Ref.: ID8A013009	Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Aluminum	13200	26.6	6.64
Antimony	ND	13.3	1.33
Arsenic	7.44	1.33	0.531
Barium	102	1.33	0.266
Beryllium	1.97	1.33	0.266
Cadmium	6.43	1.33	0.133
Calcium	471	133	13.3
Chromium	15.9	2.66	0.266
Cobalt	28.1	2.66	0.266
Copper	171	2.66	0.266
Iron	31700	26.6	3.98
Lead	1170	1.33	0.266
Magnesium	1180	133	13.3
Manganese	1000	1.33	0.133
Nickel	34.0	2.66	0.266
Potassium	1530	664	33.2
Selenium	2.38	1.33	0.664
Silver	ND	2.66	0.332
Sodium	36.7J	133	13.3
Thallium	0.720J	2.66	0.664
Vanadium	31.5	2.66	0.664
Zinc	111	1.33	0.664

RL: Reporting Limit

METHOD 3050B/6010B
METALS BY ICP

Client	: SHAW E&I	Date Collected:	01/03/08 14:30
Project	: FORT MCCLELLAN	Date Received:	01/07/08
SDG NO.	: 08A032	Date Extracted:	01/10/08 10:35
Sample ID:	AF002	Date Analyzed:	01/15/08 18:46
Lab Samp ID:	A032-02	Dilution Factor:	1
Lab File ID:	ID8A013023	Matrix :	SOIL
Ext Btch ID:	IPA011S	% Moisture :	22.1
Calib. Ref.:	ID8A013021	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Aluminum	14700	25.7	6.42
Antimony	ND	12.8	1.28
Arsenic	11.5	1.28	0.513
Barium	77.5	1.28	0.257
Beryllium	1.58	1.28	0.257
Cadmium	11.8	1.28	0.128
Calcium	481	128	12.8
Chromium	24.8	2.57	0.257
Cobalt	21.5	2.57	0.257
Copper	132	2.57	0.257
Iron	54700	25.7	3.85
Lead	342	1.28	0.257
Magnesium	2630	128	12.8
Manganese	748	1.28	0.128
Nickel	40.6	2.57	0.257
Potassium	1160	642	32.1
Selenium	4.14	1.28	0.642
Silver	ND	2.57	0.321
Sodium	38.6J	128	12.8
Thallium	0.764J	2.57	0.642
Vanadium	44.6	2.57	0.642
Zinc	132	1.28	0.642

RL: Reporting Limit

METHOD 3050B/6010B
METALS BY ICP

Client	: SHAW E&I	Date Collected:	01/03/08 10:43
Project	: FORT MCCLELLAN	Date Received:	01/07/08
SDG NO.	: 08A032	Date Extracted:	01/10/08 10:35
Sample ID:	AF003	Date Analyzed:	01/15/08 18:51
Lab Samp ID:	A032-03	Dilution Factor:	1
Lab File ID:	ID8A013024	Matrix :	SOIL
Ext Btch ID:	IPA011S	% Moisture :	24.4
Calib. Ref.:	ID8A013021	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Aluminum	20700	26.5	6.61
Antimony	ND	13.2	1.32
Arsenic	8.04	1.32	0.529
Barium	217	1.32	0.265
Beryllium	1.69	1.32	0.265
Cadmium	5.12	1.32	0.132
Calcium	2110	132	13.2
Chromium	22.0	2.65	0.265
Cobalt	22.6	2.65	0.265
Copper	31.8	2.65	0.265
Iron	25800	26.5	3.97
Lead	295	1.32	0.265
Magnesium	1200	132	13.2
Manganese	3020	1.32	0.132
Nickel	26.5	2.65	0.265
Potassium	1120	661	33.1
Selenium	1.54	1.32	0.661
Silver	ND	2.65	0.331
Sodium	38.5J	132	13.2
Thallium	2.38J	2.65	0.661
Vanadium	43.2	2.65	0.661
Zinc	79.3	1.32	0.661

RL: Reporting Limit

METHOD 3050B/6010B
METALS BY ICP

Client	: SHAW E&I	Date Collected:	01/03/08 10:20
Project	: FORT MCCLELLAN	Date Received:	01/07/08
SDG NO.	: 08A032	Date Extracted:	01/10/08 10:35
Sample ID:	AF004	Date Analyzed:	01/15/08 18:13
Lab Samp ID:	A032-04	Dilution Factor:	1
Lab File ID:	ID8A013017	Matrix :	SOIL
Ext Btch ID:	IPA011S	% Moisture :	19.5
Calib. Ref.:	ID8A013009	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Aluminum	10900	24.8	6.21
Antimony	ND	12.4	1.24
Arsenic	8.23	1.24	0.497
Barium	92.2	1.24	0.248
Beryllium	1.41	1.24	0.248
Cadmium	7.57	1.24	0.124
Calcium	653	124	12.4
Chromium	19.0	2.48	0.248
Cobalt	34.7	2.48	0.248
Copper	101	2.48	0.248
Iron	37400	24.8	3.73
Lead	359	1.24	0.248
Magnesium	1350	124	12.4
Manganese	866	1.24	0.124
Nickel	31.7	2.48	0.248
Potassium	1460	621	31.1
Selenium	2.81	1.24	0.621
Silver	ND	2.48	0.311
Sodium	33.4J	124	12.4
Thallium	0.856J	2.48	0.621
Vanadium	38.3	2.48	0.621
Zinc	100	1.24	0.621

RL: Reporting Limit

METHOD 3050B/6010B
METALS BY ICP

Client	: SHAW E&I	Date Collected:	01/03/08 10:20
Project	: FORT MCCLELLAN	Date Received:	01/07/08
SDG NO.	: 08A032	Date Extracted:	01/10/08 10:35
Sample ID:	AF005	Date Analyzed:	01/15/08 18:57
Lab Samp ID:	A032-05	Dilution Factor:	1
Lab File ID:	ID8A013025	Matrix :	SOIL
Ext Btch ID:	IPA011S	% Moisture :	22.1
Calib. Ref.:	ID8A013021	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Aluminum	8690	25.7	6.42
Antimony	ND	12.8	1.28
Arsenic	4.02	1.28	0.513
Barium	83.7	1.28	0.257
Beryllium	0.886J	1.28	0.257
Cadmium	2.25	1.28	0.128
Calcium	148	128	12.8
Chromium	12.5	2.57	0.257
Cobalt	32.9	2.57	0.257
Copper	34.2	2.57	0.257
Iron	12200	25.7	3.85
Lead	157	1.28	0.257
Magnesium	448	128	12.8
Manganese	542	1.28	0.128
Nickel	9.70	2.57	0.257
Potassium	438J	642	32.1
Selenium	1.12J	1.28	0.642
Silver	ND	2.57	0.321
Sodium	23.0J	128	12.8
Thallium	ND	2.57	0.642
Vanadium	20.1	2.57	0.642
Zinc	33.5	1.28	0.642

RL: Reporting Limit

METHOD 3050B/6010B
METALS BY ICP

Client	: SHAW E&I	Date Collected:	01/03/08 10:23
Project	: FORT MCCLELLAN	Date Received:	01/07/08
SDG NO.	: 08A032	Date Extracted:	01/10/08 10:35
Sample ID:	AF006	Date Analyzed:	01/15/08 19:02
Lab Samp ID:	A032-06	Dilution Factor:	1
Lab File ID:	ID8A013026	Matrix :	SOIL
Ext Btch ID:	IPA011S	% Moisture :	20.4
Calib. Ref.:	ID8A013021	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Aluminum	16200	25.1	6.28
Antimony	ND	12.6	1.26
Arsenic	8.58	1.26	0.503
Barium	226	1.26	0.251
Beryllium	2.90	1.26	0.251
Cadmium	6.59	1.26	0.126
Calcium	814	126	12.6
Chromium	25.0	2.51	0.251
Cobalt	38.4	2.51	0.251
Copper	55.9	2.51	0.251
Iron	31300	25.1	3.77
Lead	119	1.26	0.251
Magnesium	1310	126	12.6
Manganese	5420	1.26	0.126
Nickel	57.0	2.51	0.251
Potassium	976	628	31.4
Selenium	1.60	1.26	0.628
Silver	ND	2.51	0.314
Sodium	35.6J	126	12.6
Thallium	4.84	2.51	0.628
Vanadium	37.6	2.51	0.628
Zinc	123	1.26	0.628

RL: Reporting Limit

METHOD 3050B/6010B
METALS BY ICP

Client	: SHAW E&I	Date Collected:	01/03/08 14:50
Project	: FORT MCCLELLAN	Date Received:	01/07/08
SDG NO.	: 08A032	Date Extracted:	01/10/08 10:35
Sample ID:	AF007	Date Analyzed:	01/15/08 19:08
Lab Samp ID:	A032-07	Dilution Factor:	1
Lab File ID:	ID8A013027	Matrix :	SOIL
Ext Btch ID:	IPA011S	% Moisture :	25.5
Calib. Ref.:	ID8A013021	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Aluminum	10100	26.8	6.71
Antimony	ND	13.4	1.34
Arsenic	3.56	1.34	0.537
Barium	109	1.34	0.268
Beryllium	1.19J	1.34	0.268
Cadmium	2.62	1.34	0.134
Calcium	918	134	13.4
Chromium	11.9	2.68	0.268
Cobalt	18.2	2.68	0.268
Copper	68.7	2.68	0.268
Iron	13300	26.8	4.03
Lead	139	1.34	0.268
Magnesium	939	134	13.4
Manganese	968	1.34	0.134
Nickel	34.1	2.68	0.268
Potassium	674	671	33.6
Selenium	1.09J	1.34	0.671
Silver	ND	2.68	0.336
Sodium	42.8J	134	13.4
Thallium	0.855J	2.68	0.671
Vanadium	21.7	2.68	0.671
Zinc	72.8	1.34	0.671

RL: Reporting Limit

METHOD 3050B/6010B
METALS BY ICP

Client	: SHAW E&I	Date Collected:	01/02/08 14:55
Project	: FORT MCCLELLAN	Date Received:	01/07/08
SDG NO.	: 08A032	Date Extracted:	01/10/08 10:35
Sample ID:	AF009	Date Analyzed:	01/15/08 19:13
Lab Samp ID:	A032-08	Dilution Factor:	1
Lab File ID:	ID8A013028	Matrix :	SOIL
Ext Btch ID:	IPA011S	% Moisture :	17.2
Calib. Ref.:	ID8A013021	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Aluminum	10900	24.2	6.04
Antimony	ND	12.1	1.21
Arsenic	6.94	1.21	0.483
Barium	64.7	1.21	0.242
Beryllium	1.15J	1.21	0.242
Cadmium	5.92	1.21	0.121
Calcium	223	121	12.1
Chromium	18.0	2.42	0.242
Cobalt	26.1	2.42	0.242
Copper	105	2.42	0.242
Iron	31000	24.2	3.62
Lead	281	1.21	0.242
Magnesium	1150	121	12.1
Manganese	606	1.21	0.121
Nickel	24.5	2.42	0.242
Potassium	1190	604	30.2
Selenium	2.59	1.21	0.604
Silver	ND	2.42	0.302
Sodium	35.3J	121	12.1
Thallium	ND	2.42	0.604
Vanadium	33.7	2.42	0.604
Zinc	84.5	1.21	0.604

RL: Reporting Limit

METHOD 3050B/6010B
METALS BY ICP

Client	: SHAW E&I	Date Collected:	01/03/08 12:43
Project	: FORT MCCLELLAN	Date Received:	01/07/08
SDG NO.	: 08A032	Date Extracted:	01/10/08 10:35
Sample ID:	AF008	Date Analyzed:	01/15/08 19:19
Lab Samp ID:	A032-09	Dilution Factor:	1
Lab File ID:	ID8A013029	Matrix :	SOIL
Ext Btch ID:	IPA011S	% Moisture :	17.3
Calib. Ref.:	ID8A013021	Instrument ID :	EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Aluminum	7370	24.2	6.05
Antimony	ND	12.1	1.21
Arsenic	5.20	1.21	0.484
Barium	59.1	1.21	0.242
Beryllium	0.485J	1.21	0.242
Cadmium	4.12	1.21	0.121
Calcium	322	121	12.1
Chromium	18.2	2.42	0.242
Cobalt	5.99	2.42	0.242
Copper	12.2	2.42	0.242
Iron	22700	24.2	3.63
Lead	107	1.21	0.242
Magnesium	376	121	12.1
Manganese	108	1.21	0.121
Nickel	9.93	2.42	0.242
Potassium	473J	605	30.2
Selenium	1.97	1.21	0.605
Silver	ND	2.42	0.302
Sodium	33.0J	121	12.1
Thallium	ND	2.42	0.605
Vanadium	26.1	2.42	0.605
Zinc	32.1	1.21	0.605

RL: Reporting Limit

METHOD 7471A
MERCURY BY COLD VAPOR

Client : SHAW E&I
Project : FORT MCCLELLAN
Batch No. : 08A032

Matrix : SOIL
Instrument ID : TI047

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/kg)	DLF	MOIST	RL (mg/kg)	MDL (mg/kg)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1S	HGA014SB	ND	1	NA	0.100	0.0330	01/11/0811:51	01/10/0816:30	M47A009010	M47A009008	HGA014S	NA	01/10/08
LCS1S	HGA014SL	0.802	1	NA	0.100	0.0330	01/11/0811:53	01/10/0816:30	M47A009011	M47A009008	HGA014S	NA	01/10/08
LCD1S	HGA014SC	0.798	1	NA	0.100	0.0330	01/11/0811:55	01/10/0816:30	M47A009012	M47A009008	HGA014S	NA	01/10/08
AF004AS	A032-04A	0.476	1	19.5	0.124	0.0410	01/11/0811:57	01/10/0816:30	M47A009013	M47A009008	HGA014S	01/03/08	01/07/08
AF004	A032-04	0.0743J	1	19.5	0.124	0.0410	01/11/0811:59	01/10/0816:30	M47A009014	M47A009008	HGA014S	01/03/08	01/07/08
AF004DL	A032-04J	ND	5	19.5	0.621	0.205	01/11/0812:01	01/10/0816:30	M47A009015	M47A009008	HGA014S	01/03/08	01/07/08
AF004MS	A032-04M	1.04	1	19.5	0.124	0.0410	01/11/0812:03	01/10/0816:30	M47A009016	M47A009008	HGA014S	01/03/08	01/07/08
AF004MSD	A032-04S	1.03	1	19.5	0.124	0.0410	01/11/0812:05	01/10/0816:30	M47A009017	M47A009008	HGA014S	01/03/08	01/07/08
AF001	A032-01	0.0950J	1	24.7	0.133	0.0438	01/11/0812:07	01/10/0816:30	M47A009018	M47A009008	HGA014S	01/03/08	01/07/08
AF002	A032-02	0.134	1	22.1	0.128	0.0424	01/11/0812:09	01/10/0816:30	M47A009019	M47A009008	HGA014S	01/03/08	01/07/08
AF003	A032-03	0.0778J	1	24.4	0.132	0.0437	01/11/0812:15	01/10/0816:30	M47A009022	M47A009020	HGA014S	01/03/08	01/07/08
AF005	A032-05	0.0477J	1	22.1	0.128	0.0424	01/11/0812:18	01/10/0816:30	M47A009023	M47A009020	HGA014S	01/03/08	01/07/08
AF006	A032-06	0.0685J	1	20.4	0.126	0.0415	01/11/0812:19	01/10/0816:30	M47A009024	M47A009020	HGA014S	01/03/08	01/07/08
AF007	A032-07	0.0855J	1	25.5	0.134	0.0443	01/11/0812:21	01/10/0816:30	M47A009025	M47A009020	HGA014S	01/03/08	01/07/08
AF009	A032-08	0.0535J	1	17.2	0.121	0.0399	01/11/0812:23	01/10/0816:30	M47A009026	M47A009020	HGA014S	01/02/08	01/07/08
AF008	A032-09	0.0451J	1	17.3	0.121	0.0399	01/11/0812:25	01/10/0816:30	M47A009027	M47A009020	HGA014S	01/03/08	01/07/08

RL: Reporting Limit

APPENDIX C

XRF AND LABORATORY DATA CORRELATION ASSESSMENT

Shaw
Shaw Environmental & Infrastructure, Inc.

MEMORANDUM

To: Steve Moran, Troy Winton Date: April 10, 2008

From: Randy McBride

RE: XRF Data to Laboratory Data Comparison in Response to ADEM Comments on Range RI Reports

1.0 Introduction. In October 2007 representatives of Shaw, USACE, Army, and ADEM attended a teleconference to discuss the ADEM comments and concerns regarding the x-ray fluorescence (XRF) survey specifically conducted at the Iron Mountain Road (IMR) Ranges, but in general to all those conducted base wide. ADEM issued these comments to the Army on April 2, 2007 for the Draft RI Report of IMR Ranges (Shaw, 2004). At the telecon, Shaw satisfactorily addressed the concerns of ADEM about the quality assurance procedures (i.e., equipment calibrations and sample preparation steps) that are incorporated in all XRF surveys. ADEM also asked Shaw to clarify the laboratory confirmation analysis procedures which were used to select, prepare, and analyze split samples from the XRF surveys. Confirmation analyses are conducted at an offsite laboratory using standard EPA analytical methods on samples which were previously screened by the XRF in the field. Typically Shaw uses a frequency of 10 percent of the total number of samples in the XRF survey to determine the number of samples for confirmation analysis.

One of the main issues of concern identified by ADEM was how for the IMR Ranges a total of 40 samples were collected for the XRF survey and 10 percent (4 samples) were selected for confirmation analyses for lead. The results were adequately summarized in the RI report; however the interpretation of the confirmation sample data was not complete. Because the number of XRF confirmation samples were so few for any specific scope of work, ADEM requested that Shaw prepare an XRF to laboratory comparison summary to present the lead results of all the XRF confirmation samples collected to date at Fort McClellan. To address this at the telecon, Shaw prepared Figure 1. It was generally agreed at the telecon after looking at Figure 1 that an acceptable correlation was achieved and Shaw should present this

information in all range RI reports where XRF surveys had been conducted.

Recently however when Shaw personnel were in the process of reviewing this information for inclusion into the IMR RI Report Draft-Final revision, it was determined that the graph presented as Figure 1 during the telecon was prepared in error. The wrong data column was used to plot the results for the graph and therefore the graph had to be redrawn using the correct laboratory results from the confirmation samples. To that end, Shaw has thoroughly reviewed and checked all laboratory data for all the XRF surveys conducted to date at Fort McClellan and has prepared a revised figure for consideration.

2.0 Data Evaluation. At the time of the preparation of this memo from 2001 to 2008, a total of 93 locations have been analyzed for lead in the field using XRF and analyzed in the laboratory.

2.1 Data Distribution. It should be noted the XRF was never used to generate data which was used in risk assessments. XRF data were used to determine the presence or absence of significant contamination in areas that were suspected of being devoid of contamination (i.e. range safety fans) to confirm that additional sampling and analyses were not needed in these areas and to identify hot spots in areas of known or suspected contamination (i.e. impact areas). However to place the range of XRF-measured values in a context to better understand their distribution, the following summarizes key concentrations for lead data evaluation:

- Surface soil background screening value - 40.05 mg/kg
- Ecological screening value (ESV) – 50 mg/kg
- Residential human health site-specific screening level (SSSL) - 400 mg/kg
- Recreational site user SSSL - 7,600 mg/kg

If these levels are compared to the XRF confirmation sample concentrations: 23 results (25%) are less than the background screening value; 28 results (30%) are less than the ESV; 71 results (76%) are less than the residential SSSL and all results are less than the recreational site user SSSL. This distribution is somewhat biased towards the lower end of concentration scale because most of the XRF surveys at McClellan have been conducted to support range safety fan investigations where very low concentrations of lead are expected.

A total of 81 locations (87%) have lead values less than 1,000 mg/kg. Those remaining samples greater than 1,000 mg/kg were collected from range impact areas and therefore may likely contain particulate lead. The presence of particulate lead directly leads to an increase of the variability among the analytical results because of the increased heterogeneity and the resulting biased distribution of lead particles in the analyzed sample aliquots.

2.2 Linear Regression Models. In a comparison summary of XRF data to laboratory confirmation data, increased variability due to particulate lead in only one or two samples can bias the entire comparison in a significantly negative way. To compensate for this, Shaw has prepared two data comparison figures. Figure 2 shows the comparison of all 93 sample data points as a simple linear regression. Figure 3 is also a linear regression model, but only displays the 81 results which were between the XRF reporting limit (approximately 14 mg/kg) and 1,000 mg/kg. Regression analysis on Figure 2 indicates a coefficient of determination (R^2) value of .7355 for all data while on Figure 3 an R^2 value of .8877 is obtained using the smaller data set. In this kind of simple regression, a perfect relationship would be expressed by an R^2 value of 1.000. Therefore a "good" relationship is reflected in Figure 2 for all values, a "better" relationship is shown in Figure 3 for those values below 1,000 mg/kg.

2.3 Kendall's Tau. Another statistical test was used to evaluate correlation using the data from the XRF and laboratory confirmation samples. Kendall's tau is a nonparametric correlation coefficient which is intended to measure "strength of relationship." Strength of relationship is generally defined as the strength of the tendency of two variables, X and Y, to move in the same (opposite) direction. A value of "+1" indicates that the agreement between the two rankings is perfect (i.e., the two rankings are the same). A value of -1 indicates the disagreement between the two rankings is perfect (i.e., one ranking is the reverse of the other) and a value of "0" indicates the rankings are completely independent. The Kendall's tau value for the complete set of XRF and lab results (93 total results) is 0.873, which confirms the linear regression model conclusion that the XRF and laboratory confirmation data are statistically in agreement and exhibit a strong relationship.

2.4 Relative Percent Difference. In addition to the regression data analysis, Shaw also calculated the relative percent difference (RPD) between paired XRF and laboratory confirmation results to determine how well they agree. Table 1 summarizes this comparison. As shown on Table 1, the range of RPDs from all 93 pairs of data varies from 0% to 137% with an average RPD of 27% and standard deviation (σ) of 26%. When RPD is examined

over the range of XRF-measured lead concentrations and is broken out into the groupings discussed in Section 2.1, it is evident that RPD increases in the range of values on the lowest end ("less than 50 mg/kg" – average RPD of 33%, σ of 30%) and the highest end ("greater than 1,000 mg/kg" – average RPD of 38%, σ of 42%). Values in the middle groupings: "greater than 50 but less than 400 mg/kg" – average RPD of 20%, σ of 17% and "greater than 400 but less than 1,000 mg/kg" – average RPD of 29%, σ of 18%; showed the lowest average differences and lowest standard deviations.

This trend is expected as variability of the measurement increases at the lowest concentrations and variability of the sample increases at the highest concentrations. This distribution of calculated RPDs supports the conclusion that for samples in the range of values that is most important for the remedial investigations conducted, the percent differences are manageable and reasonable. The relatively small differences between XRF and laboratory-measured values, especially in the important middle value range, supports XRF data usability.

2.5 Assessing Potential XRF Bias. Using the slope/intercept data shown on the regression with the best linear relationship (Figure 3), it appears that the y-intercept for the regression line shows a computed laboratory concentration of -23.8 mg/kg when the x-axis value (the XRF result) would equal true "zero." This indicates that the XRF results are overall slightly elevated when compared to the laboratory method. This is somewhat expected as the XRF analysis uses x-rays to cause all metals present in the sample window to fluoresce during an analysis. The laboratory method SW-846 6010B, relies on an acid digestion preparation step (SW-846, 3050B) and the preparation will have less than 100 percent extraction efficiency.

3.0 Conclusion. Figure 2 and Figure 3 show quite clearly that with the exception of a few samples in the upper end of the concentration range, the majority of samples correlate quite well. Evidence of this relationship is further supported by the Kendall's tau evaluation. In addition to the overall relationship of the data types, when the RPD of the paired values are also considered, especially in the range of values of interest (near the lead ESV and SSSL values), the individual results taken in total also support the conclusion that the XRF methodology is yielding data that is directly comparable to the laboratory method. Both the XRF and laboratory data agree that the XRF has been completely successful in differentiating samples with lower level lead concentrations from those with high concentrations.

It is important to realize that these lead measurements take two fundamentally different analytical approaches to quantify the concentrations present and differences between the results are to be expected. For a field method, the XRF-measured data should be considered usable for their intended purpose to generate non-definitive screening-level data and therefore specifically for the IMR Ranges, the safety fan survey is complete.

It is therefore Shaw's intention to address the ADEM comments by presenting Figure 2 and Figure 3, Table 1, as well as the discussion summarized in this memo in the Draft-Final revision of the IMR RI Report and to all other range RI reports where XRF surveys were conducted.

FIGURES

Figure 1.
XRF to Lab Comparison - Pb, All sites
(as presented during October 2007 Telecon with ADEM)

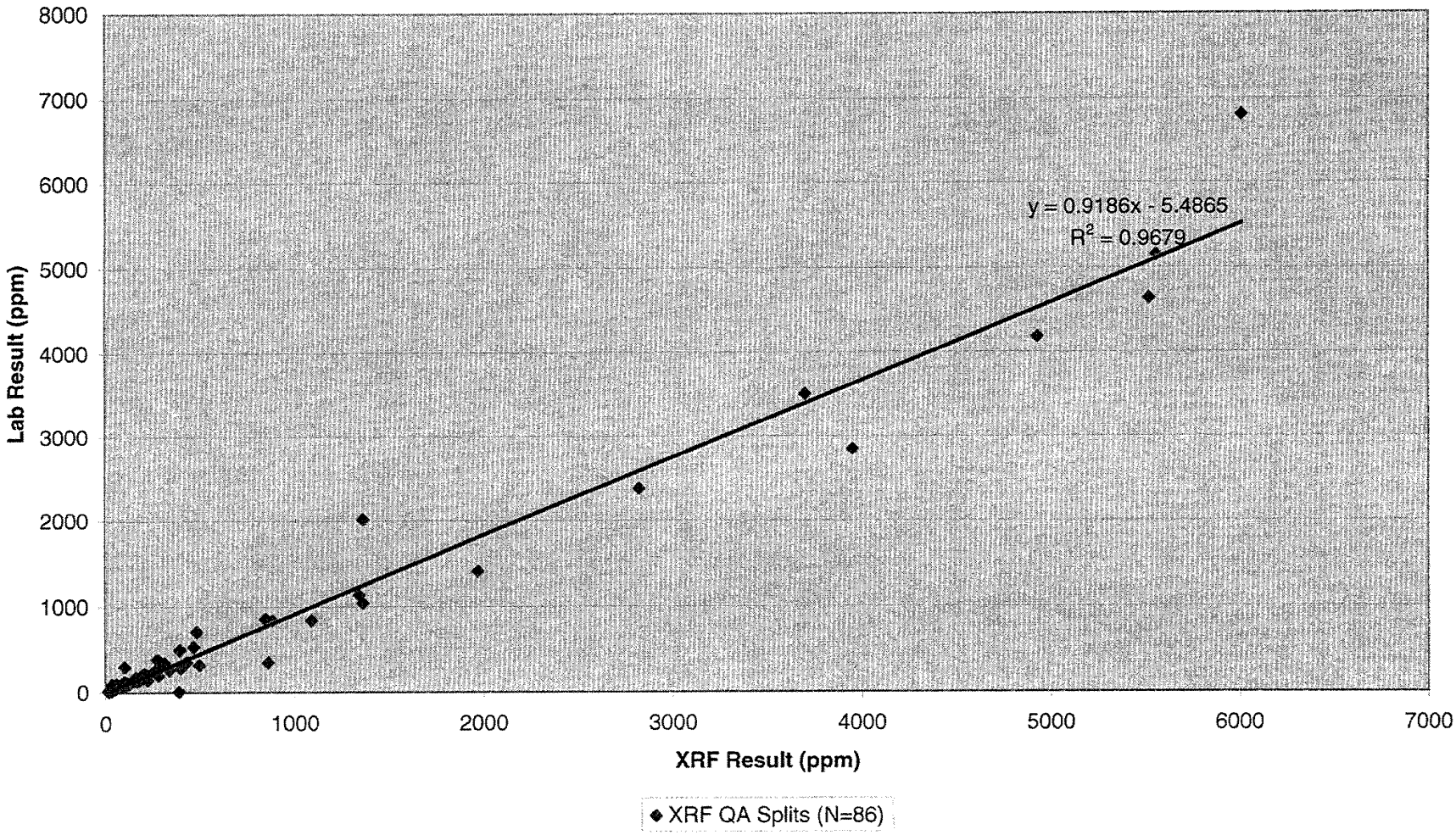


Figure 2.
XRF and Laboratory Confirmation Analysis Summary, All Values Measured
Fort McClellan XRF Surveys Combined (2001 - 2008)

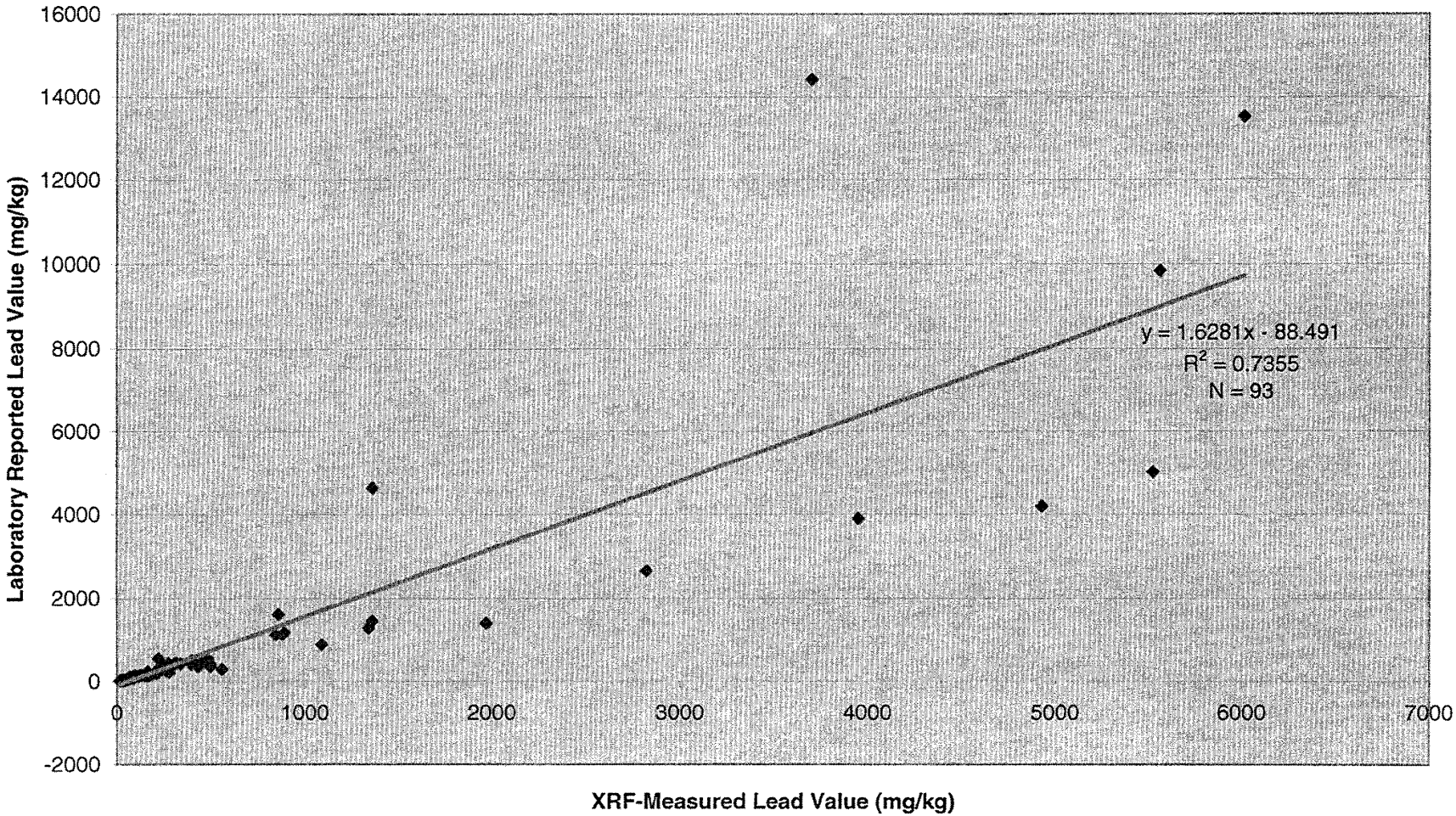
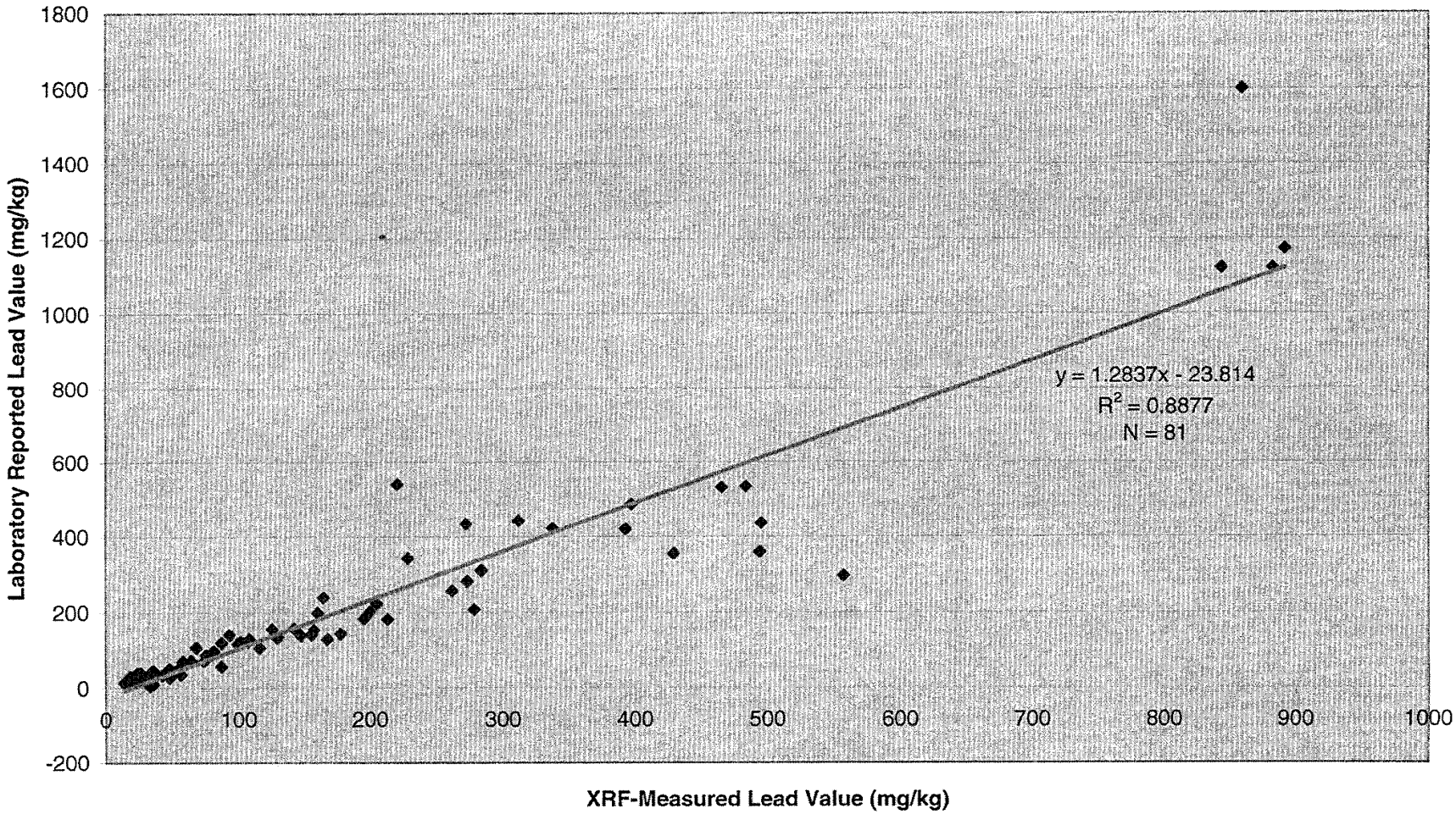


Figure 3.
XRF and Laboratory Confirmation Analysis Summary, All XRF Values Less Than 1,000 mg/kg
Fort McClellan XRF Surveys Combined (2001 - 2008)



TABLES

Table 1.
XRF vs Lab Comparisons - Relative Percent Difference
All Fort McClellan XRF Surveys Collected (2001-2008)

Area of Investigation Parcel(s)	Sample Location	Lead, mg/kg XRF	Lead, mg/kg Lab	RPD	
CC SS (RI)	CCRI-SS-(S2000, E600)	14	15.3	9%	
CC SS (RI)	CCRI-SS-(S400, E1000)	14	13.5	4%	
P137Q SS (RI)	137Q-SS-(N400, W600)	16.3	14.5	12%	
CC SS (RI)	CCRI-SS-(S1400, E1000)	17.1	11.9	36%	
T24A Range Safety Fans	R24X33	17.1	15.6	9%	
IMR / BGR Safety Fan	IMR-XRF06	18	29.9	50%	
CC SS (RI)	CCRI-SS-(N2400, E800)	19.1	28.5	39%	
CC SS (RI)	CCRI-SS-(N1000, E1400)	20.1	21.7	8%	
CC SS (RI)	CCRI-SS-(S1600, E0)	20.6	16.3	23%	
IMR / BGR Safety Fan	BGR-XRF10	22.6	15.8	35%	
P137Q SS (RI)	137Q-SS-(N200, W400)	23.2	37.5	47%	
IMR / BGR Safety Fan	BGR-XRF34	23.8	37.7	45%	
CC Safety Fan	CCX13	24.1	24.1	0%	
BBGR Supp (Range 20, Parcel 76Q-X)	76-GP19 (2 to 2.5)	24.2	21.9	10%	
CC Safety Fan	CCX31	25.2	20.9	19%	
CC SS (RI)	CCRI-SS-(S800, E400)	26.1	21.8	18%	
T24A SS (RI)	T24A-RI-(S400, W500)	26.1	39.3	40%	
T24A SS (RI)	T24A-RI-(S200, E300)	29.3	19.9	38%	
BBGR Supp (Range 18, Parcel 74Q)	74-GP60	30.4	24.4	22%	
CC SS (RI)	CCRI-SS-(S1400, E200)	32.3	36.4	12%	
IMR / BGR Safety Fan	IMR-XRF09	33.1	6.23	137%	
CC Safety Fan	CCX01	35.5	45.6	25%	
IMR / BGR Safety Fan	IMR-XRF27	35.5	10.8	107%	
BBGR R25 Safety Fan	R25X23	42.5	34	22%	
CC SS (RI)	CCRI-SS-(S1400, W1200)	47.9	51	6%	All <50 mg/kg,
BBGR Supp (Range 20, Parcel 76Q-X)	76-GP14 (2 to 2.5)	48.2	27.2	56%	N=28
CC Safety Fan	CCX26	48.6	29.1	50%	Avg - 33% RPD
BBGR R25 Safety Fan	R25X13	48.7	34.5	34%	Std Dev - 30%
CC SS (RI)	CCRI-SS-(S200, E600)	51.8	40.3	25%	
CC SS (RI)	CCRI-SS-(N600, E400)	54.7	42.4	25%	
IMR / BGR Safety Fan	BGR-XRF39	55.6	54.8	1%	
T24A Range Safety Fans	R24X16	56.4	35.5	45%	
CC Safety Fan	CCX10	58	70.2	19%	
T24A SS (RI)	T24A-RI-(N100, E600)	64.2	72	11%	
OA-03 (SI)	OA03-XRF-43	68	107	45%	
CC SS (RI)	CCRI-SS-(S1400, W2000)	74	71.4	4%	
CC SS (RI)	CCRI-SS-(N1400, W600)	75.4	86.5	14%	
CC SS (RI)	CCRI-SS-(S1600, W400)	81.2	97.7	18%	
OA-03 (SI)	OA03-XRF-44	87	119	31%	
T24A Range Safety Fans	R24X24	87.1	57.1	42%	
OA-03 (SI)	OA03-XRF-35	93	139	40%	
CC SS (RI)	CCRI-SS-(N1800, E300)	99.1	116	16%	
CC SS (RI)	CCRI-SS-(S900, W600)	101.7	121	17%	
CC SS (RI)	CCRI-SS-(N300, E200)	107.1	122	13%	
IMR / BGR Safety Fan	IMR-XRF19	108	129	18%	
T24A SS (RI)	T24A-RI-(N500, W100)	115.8	106	9%	
P137Q SS (RI)	137Q-SS-(N200, W300)	125.1	155	21%	
CC SS (RI)	CCRI-SS-(N200, W100)	129.4	133	3%	
OA-03 (SI)	OA03-XRF-34	142	157	10%	
CC SS (RI)	CCRI-SS-(S1200, W1400)	147.1	138	6%	
BBGR Supp (Range 18, Parcel 74Q)	74-GP61	155	140	10%	

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Area of Investigation Parcel(s)	Sample Location	Lead, mg/kg XRF	Lead, mg/kg Lab	RPD	
CC SS (RI)	CCRI-SS-(S1200, W1800)	157.1	153	3%	
CC SS (RI)	CCRI-SS-(N1200, W400)	159.9	198	21%	
P137Q SS (RI)	137Q-SS-(S300, E700)	164.1	238	37%	
T24A SS (RI)	T24A-RI-(N100, E300)	167	129	26%	
T24A SS (RI)	T24A-RI-(S300, E200)	177	143	21%	
BBGR R25 Safety Fan	R25X03	195	183	6%	
CC SS (RI)	CCRI-SS-(S1300, W1300)	199.3	201	1%	
T24A SS (RI)	T24A-RI-(N300, E100)	204.4	222	8%	
T24A SS (RI)	T24A-RI-(N400, W100)	212.8	182	16%	
BBGR Supp (Range 20, Parcel 76Q-X)	76-GP14 (0 to 1)	220	539	84%	
OA-03 (SI)	OA03-XRF-41	228	342	40%	
T24A SS (RI)	T24A-RI-(N200, W300)	261.6	255	3%	
IMR / BGR Safety Fan	BGR-XRF04	272	433	46%	
OA-03 (SI)	OA03-XRF-23	273	281	3%	
CC SS (RI)	CCRI-SS-(S1000, W1200)	278.2	207	29%	
T24A SS (RI)	T24A-RI-(N100, 0)	283.8	309	9%	All >50 mg/kg,
P137Q SS (RI)	137Q-SS-(S100, W100)	311.6	441	34%	and <400 mg/kg,
CC SS (RI)	CCRI-SS-(S600, E1000)	337.4	421	22%	N=43
CC SS (RI)	CCRI-SS-(N2300, E200)	392.4	419	7%	Avg - 20% RPD
BBGR Supp (Range 18, Parcel 74Q)	74-GP66+400'SE	397	486	20%	Std Dev - 17%
T24A SS (RI)	T24A-RI-(N400, E200)	428.8	354	19%	
T24A SS (RI)	T24A-RI-(S100, W600)	465.2	531	13%	
CC SS (RI)	CCRI-SS-(S1600, W1000)	483.6	533	10%	
OA-03 (SI)	OA03-XRF-33	494	359	32%	
T24A Range Safety Fans	R24X05	495	434	13%	
OA-03 (SI)	OA03-XRF-36	557	295	62%	All >400 mg/kg,
P137Q SS (RI)	137Q-SS-(N100, E100)	843.2	1120	28%	and <1,000 mg/kg,
CC SS (RI)	CCRI-SS-(N1300, W500)	858.4	1600	60%	N=10
BBGR Supp (Range 20, Parcel 76Q-X)	76-GP15 (0 to 1)	882	1120	24%	Avg - 29% RPD
OA-03 (SI)	OA03-XRF-42	891	1170	27%	Std Dev - 18%
T24A SS (RI)	T24A-RI-(N300, E500)	1089.6	883	21%	
BBGR Supp (Range 18, Parcel 74Q)	74-GP57+50'SE	1340	1280	5%	
CC SS (RI)	CCRI-SS-(S600, W1000)	1360	1450	6%	
CC SS (RI)	CCRI-SS-(S1000, W400)	1360	4620	109%	
T24A SS (RI)	T24A-RI-(S300, 0)	1969.6	1400	34%	
BBGR Supp (Range 25, Parcel 83Q/118Q-X)	118-GP13	2820	2650	6%	
BBGR Supp (Range 18, Parcel 74Q)	74-GP57	3700	14400	118%	
BBGR Supp (Range 18, Parcel 74Q)	74-GP47	3950	3890	2%	
T24A SS (RI)	T24A-RI-(S100, W250 (Mound))	4928	4180	16%	All >1,000 mg/kg
BBGR Supp (Range 18, Parcel 74Q)	74-GP64	5520	5000	10%	N=12
CC SS (RI)	CCRI-SS-(S400, W300)	5558.4	9820	55%	Avg - 38% RPD
P137Q SS (RI)	137Q-SS-(0, E500)	6009.6	13500	77%	Std Dev - 42%
		All values:	Max:	137%	
		N=93	Min:	0.0%	
			Avg:	27%	
			Std Dev:	26%	