DEPARTMENT OF THE ARMY
US ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND MD 21010-5403

0 8 OCT 2009

MCHB-TS-RDE

MEMORANDUM FOR Office of the Command Surgeon (MAJ (b) (6)), US Central Command, 7115 South Boundary Boulevard, MacDill Air Force Base, FL 33621-5101

SUBJECT: Deployment Occupational and Environmental Health Risk Characterization, Ambient Air Particulate Matter Samples, Bucca, Iraq, 20 February-29 June 2009, U_IRQ_BUCCA_CM_A25_20090629

1. The enclosed assessment details the occupational and environmental health (OEH) risk characterization for ambient air particulate matter samples collected by Task Force 115 Preventive Medicine personnel at Bucca, Iraq, 20 February-29 June 2009. Twenty three of twenty five filters submitted are valid samples.

2. The OEH risk estimate for exposure to particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) and metals in the ambient air at Bucca, Iraq on the sampled dates is **moderate** due to elevated levels of $PM_{2.5}$. Exposure to the ambient air during this sampling event may have degraded unit readiness; periods with similar ambient conditions are expected to cause similar health effects.

FOR THE COMMANDER:

(b) (6)

Director, Health Risk Management

Encl

CF: (w/encl)
320th MP BN (Preventive Medicine OIC/1LT (b) (6)
320th MP BN (Preventive Medicine NCOIC/SGT (b) (6)
306th MP BN (Preventive Medicine OIC/CPT (b)
306th MP BN (Preventive Medicine NCOIC/SSG (b) (6)
TF 31/391st MP BN (Sanitary Engineer/MAJ (b) (6)
MNC-I (Command Surgeon Office/LTC (b) (6)
MNF-I CJ148 (Commander/CDR (b) (6)
ARCENT (Command Surgeon Office/LTC (b) (6)
ARCENT (Force Health Protection Officer/LTC (b) (6)
CFLCC/USA 3RD MDSC (MAJ (b) (6)
(CONT)

MCHB-TS-RDE
SUBJECT: Deployment Occupational and Environmental Health Risk Characterization, Ambient Air Particulate Matter Samples, Bucca, Iraq, 20 February-29 June 2009, U_IRQ_BUCCA_CM_A25_20090629

CF: (w/encl) (CONT)
1st MED BDE (Environmental Science Officer/SFC (b) (6)
1st MED BDE (Environmental Science Officer/MSG (b) (6)
1st MED BDE (Environmental Science Officer/CPT (b) (6)
1st MED BDE (Preventive Medicine Officer/MAJ (b) (6)
111th MMB (FHP OIC Clinic Ops/1LT (b) (6)
421st MMB (Preventive Medicine OIC/1LT (b) (6)
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USACHPPM-EUR (MCHB-AE-EE/CPT (b) (6)

U.S. Army Center for Health Promotion and Preventive Medicine

DEPLOYMENT OCCUPATIONAL AND ENVIRONMENTAL
HEALTH RISK CHARACTERIZATION
AMBIENT AIR PARTICULATE MATTER SAMPLES
BUCCA, IRAQ
20 FEBRUARY-29 JUNE 2009
U_IRQ_BUCCA_CM_A25_20090629

Preventive Medicine Survey: 40-5f1

USCHPPM

Readiness Thru Health

DEPLOYMENT OCCUPATIONAL AND ENVIRONMENTAL
HEALTH RISK CHARACTERIZATION
AMBIENT AIR PARTICULATE MATTER SAMPLES
BUCCA, IRAQ
20 FEBRUARY-29 JUNE 2009
U_IRQ_BUCCA_CM_A25_20090629

1. REFERENCES. See Appendix A for a list of references.

2. PURPOSE AND SCOPE. This occupational and environmental health (OEH) risk characterization addresses the analytical results for particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) and metals ambient air samples collected on 20 February-29 June 2009 at Bucca, Iraq in accordance with U.S. Department of Defense (DOD) medical surveillance requirements. Twenty three of 25 filters submitted are valid samples. This sample set was assessed using the methodology described in Appendix B. This report should not be considered a complete assessment of the overall OEH hazards to which troops may be exposed at Bucca, Iraq.

3. BACKGROUND AND EXPOSURE ASSUMPTIONS. Ambient air $PM_{2.5}$ and metals samples were collected at the burn pit tower and the scrap metal yard at Bucca, Iraq, 20 February - 29 June 2009. There is no known industry present in the vicinity. A sandstorm was reported during the sampling event on 21 February 2009. All personnel are expected to remain at this location for greater than 1 year. A conservative (protective) assumption is that all personnel inhale the ambient air for 24 hours/day for 365 days (1 year). In addition, it is assumed that control measures and/or personal protective equipment are not used.

4. SAMPLE COLLECTION AND ANALYSIS.

a. Sample Collection. This ambient air $PM_{2.5}$ and metals sample set was collected using both the Mini-Vol™ and Deployment Particulate Sampler (DPS™) apparatus. Table 1 presents a summary of the PM filters submitted by the unit. (Mini-Vol™ is a trademark of Airmetrics, Inc.; DPS™ is a trademark of SKC, Inc.)

Table 1. Sample Summary Ambient Air PM Samples, Bucca, Iraq, 20 February-29 June 2009

Sample Identification		Date	Invalid/Reason
Field ID	Site		
IRQ BUCCA 09051 PM25MV	Burn Pit Tower	2009/02/20 1135	No
IRQ BUCCA 09094 PM25MV	Scrap Metal Yard	2009/04/03 1010	No
IRQ BUCCA 09105 PM25MV	Scrap Metal Yard	2009/04/14 0957	No
IRQ BUCCA 09115 PM25MV	Scrap Metal Yard	2009/04/24 1100	No
IRQ BUCCA 09122 PM25MV	Scrap Metal Yard	2009/05/01 1040	No

Sample Identification		Date	Invalid/Reason
Field ID	Site		
IRQ BUCCA 09129 PM25MV	Scrap Metal Yard	2009/05/08 1000	No
IRQ BUCCA 09136 PM25MV	Scrap Metal Yard	2009/05/15 1136	No
IRQ BUCCA 09151 PM25MV	Scrap Metal Yard	2009/05/30 1430	No
IRQ BUCCA 09151 PM25MV	Scrap Metal Yard	2009/05/22 1015	No
IRQ BUCCA 09158 PM25MV	Scrap Metal Yard	2009/06/06 1106	No
IRQ BUCCA 09175 PM25MV	Scrap Metal Yard	2009/06/23 1023	No
IRQ BUCCA 09181 PM25MV	Scrap Metal Yard	2009/06/29 1433	No
IRQ BUCCA PM25DPS 09052	Burn Pit Tower	2009/02/21 1101	No
IRQ BUCCA PM25DPS 09094	Burn Pit Tower	2009/04/03 1042	No
IRQ BUCCA PM25DPS 09105	Burn Pit Tower	2009/04/14 1010	No
IRQ BUCCA PM25DPS 09115	Burn Pit Tower	2009/04/24 1125	No
IRQ BUCCA Pm25DPS 09128	Burn Pit Tower	2009/05/08 1014	No
IRQ BUCCA PM25DPS 09136	Burn Pit Tower	2009/05/15 1112	No
IRQ BUCCA PM25DPS 09151	Burn Pit Tower	2009/05/30 1448	No
IRQ BUCCA PM25DPS 09175	Burn Pit Tower	2009/06/23 1102	No
IRQ BUCCA PM25DPS 09187	Burn Pit Tower	2009/06/29 1419	No
IRQ BUCCA PM25DPS 09143	Burn Pit Tower	2009/05/22 1030	No
IRQ BUCCA PM25DPS 09158	Burn Pit Tower	2009/06/06 1120	No
IRQ BUCCA 09082 PM25MV	Scrap Metal Yard	2009/03/28 1408	Yes, Missing field data
IRQ BUCCA PM25DPS 09087	Burn Pit Tower	2009/03/28 1426	Yes, Missing field data

b. Laboratory Analysis. The U.S. Army Center for Health Promotion and Preventive Medicine-Headquarters (USACHPPM-HQ) weighs the ambient air PM filters to determine PM mass and calculate a concentration. The USACHPPM-Headquarters laboratory analyzes the filters to determine metals concentrations. Appendix C shows a summary of the filters assessed in this report. Appendix D shows a sample results summary table. Appendix E, F, G, and H show complete analytical results.

5. HAZARD IDENTIFICATION.

a. The PM. Since PM was measured at a concentration above the AQI good range, PM is identified as a potential health threat requiring further assessment. The PM air pollutants include

solid particles and liquid droplets, emitted directly into the air by sources, such as, power plants, motor vehicles, aircraft, generators, construction activities, fires, and natural windblown dust. The PM can include dust, silica, soil, metals, organic compounds, allergens, and compounds, such as, nitrates or sulfates that are formed by condensation or transformation of combustion exhaust. The PM chemical composition and size vary considerably depending on the source.

b. Metals. No detected metals were found at concentrations greater than their respective MEGs. Therefore, the OEH risk estimate for exposure to metals in the ambient air at this location is considered **low**.

6. HAZARD ASSESSMENT.

a. Hazard Severity. The average concentration of $PM_{2.5}$ was 269 micrograms per cubic meter ($\mu g/m^3$). This concentration falls within the range of concentrations that are believed to pose significant respiratory effects in generally healthy troops causing some operational impact, particularly if the exposures are repeated or continuous. Uniquely susceptible personnel, such as those with asthma have an even greater risk-as exposures may induce asthma attacks. Heavy aerobic activity may exacerbate health effects caused by PM. Therefore, the hazard severity is considered marginal.

b. Hazard Probability. The hazard probability reflects the likelihood that the exposures at the location are represented by the concentrations used to determine the hazard severity. The probability that the severity of a hazard is marginal is based on a comparison of individual sample concentrations to the lowest bound of the marginal category (150 $\mu g/m^3$). During this sampling event, the range of $PM_{2.5}$ sample concentrations was 47-1,642 $\mu g/m^3$, and 14 of 23 (61 percent) of samples were above 150 $\mu g/m^3$; therefore, the probability that personnel in the sampled areas will be exposed to $PM_{2.5}$ greater than 150 $\mu g/m^3$ is considered likely.

c. Risk Estimate and Confidence. Table 2 summarizes the risk estimate for each identified hazard.

Table 2. Risk Estimate Summary for Exposure to Ambient Air PM, Bucca, Iraq,
20 February-29 June 2009

Parameter	Hazard Severity	Hazard Probability	Hazard-Specific Risk Estimate	Operational Risk Estimate	Confidence
$PM_{2.5}$	Marginal	Likely	MODERATE	MODERATE	MEDIUM
Metals	No parameters detected above a MEG		LOW		

7. CONCLUSION. The OEH risk estimate for exposure to $PM_{2.5}$ and metals in the ambient air at Bucca, Iraq, 20 February-29 June 2009 is **moderate** due to elevated levels of $PM_{2.5}$. Confidence in the risk estimate is considered medium. Exposure to the ambient air during this sampling event may have degraded unit readiness; periods with similar ambient conditions are expected to cause similar health effects.

8. RECOMMENDATIONS AND NOTES.

a. Recommendations.

(1) Restrict outdoor physical activities where possible during periods of visibly high particulate levels.

(2) Continue to collect both $PM_{2.5}$ and PM_{10} samples (when possible) from this location at least once every 6 days for the deployment duration (or as long as possible) to better characterize the PM and metals ambient air concentrations to which personnel are typically exposed.

(3) Inform preventive medicine and medical personnel of potential health effects resulting from exposures to the measured levels of ambient PM and associated heavy metals. Disease Non-Battle Injury (DNBI) rates of respiratory diseases, particularly asthma, should be followed and assessed during periods of high PM levels. If elevated DNBI respiratory illness rates (that is, above two standard deviations), or an increase in the incidence or severity of asthma, are noted during periods of high PM levels, ensure appropriate medical surveillance-related items are documents. If assistance and/or information are needed on environmental health effects and/or medical implications from exposure to PM and associated heavy metals, please contact the USACHPPM-Headquarters Environmental Medicine Program at commercial 001-410-436-2714.

b. Notes.

(1) This OEH risk assessment is specific to the exposure assumptions identified above and the sample results assessed in this report. If the assumed exposure scenario changes or additional information is available, provide the updated information so that the risk estimate can be reassessed. If additional samples from this site and/or area are collected, a new OEH risk assessment will be completed.

(2) As part of a Comprehensive Military Medical Surveillance Program, required by Department of Defense Directive (DoDD) 6490.02E and Department of Defense Instruction (DoDI) 6490.03, this report has been submitted to the Deployment Occupational and Environmental Health Surveillance - Data Portal (DOEHS-DP). You can view this and other

archived DOEHS data at https://doehrswww.apgea.army.mil/doehrs-oehs/. If you have additional DOEHS data for this location it can also be submitted via this Web site.

9. POINTS OF CONTACT. The USACHPPM points of contact for this assessment are Ms. (b) (6) and Mr. (b) (6). Ms. (b) (6) may be contacted at e-mail (b) (6), Mr. (b) may be contacted at e-mail (b) (6) or DSN (b) (6) or commercial (b) (6)

(b) (6)

Environmental Scientist
Deployment Environmental Surveillance Program

Approved by:

(b) (6)

MAJ, MS
Program Manager
Deployment Environmental Surveillance

APPENDIX A

REFERENCES

1. Department of Defense Directive (DoDD) 6490.02E, Comprehensive Health Surveillance, 21 October 2004.

2. Department of Defense Instruction (DoDI) 6490.03, Deployment Health, 11 August 2006.

3. Field Manual (FM) 5-19, Composite Risk Management, 21 August 2006.

4. USACHPPM Technical Guide (TG) 230, Chemical Exposure Guidelines for Deployed Military Personnel, Version 1.3, May 2003 with the January 2004 addendum.

5. Memorandum, USACHPPM (MCHB-TS-RDE), 27 April 2007, Subject: Deployment Operational Risk Characterization Method for Particulate Matter (PM).

APPENDIX B

METHODOLOGY

B-1. SCOPE OF RISK ASSESSMENTS. The USACHPPM Deployment Environmental Surveillance Program characterizes deployment OEH risks which may impact mission capability (that is, operational risks). Each characterization is performed using risk management doctrine (FM 5-19), and the relatively conservative (protective) assumptions and methods provided in the USACHPPM TG 230, to facilitate decision making that can minimize the likelihood of significant risks. A risk estimate is generated for each sample or sample set sent to the USACHPPM-Headquarters laboratory for analysis. These risk estimates are provided to preventive medicine personnel with information about potential operational risks and associated health effects. The samples received are generally limited in time, area, and media. Therefore, any risk characterization based on a sample or sample set should not be considered a complete characterization of the overall OEH hazards to which troops may be exposed at a location.

B-2. RISK ASSESSMENT METHODOLOGY.

a. General. USACHPPM TG 230 methodology (identification of the hazard(s), assessment of the hazard severity and probability, and determination of a risk estimate and confidence level) with the USACHPPM TG 230 military exposure guidelines (MEGs) and TB MED 577 standards are used to characterize the risk from identified OEH hazards. Each component of the methodology is described in more detail below.

b. Hazard Identification.

(1) Hazard Definition. For the purpose of conducting these risk assessments, an OEH hazard is any biological, chemical, or physical parameter detected in a medium, by field testing or laboratory analysis. The detected parameter could pose a health threat if personnel are exposed to it at levels greater than its respective MEG.

(2) Screening the Hazards.

a. General. The USACHPPM Deployment Environmental Surveillance Program uses the TG 230 methodology as expanded in Reference (1d) and associated military exposure guidelines (MEGs) to assess identified hazards and estimate risk in a manner consistent with doctrinal risk management procedures and terminology. This method includes identification of the hazard(s), assessment of the hazard severity and probability, determination of a risk estimate, and associated level of confidence. As part of the hazard identification step, the long-term (1-year) MEGs are used as screening criteria to identify those hazards that are potential health threats. These 1-year MEGs represent exposure concentrations at or below which no significant health

effects (including delayed or chronic disease or significant increased risk of cancer) are anticipated even after 1 year of continuous daily exposures. Short-term MEGs are used to assess brief one time or intermittent exposures. The underlying toxicological basis for the MEGs is addressed in RD 230. Since toxicological information about potential health effects varies among different chemicals, the determination of severity of effects when MEGs are exceeded involves professional judgment. Hazards with exposure concentrations greater than MEGs are identified as potential health threats, carried through the hazard assessment process, and assigned a risk estimate consistent with ORM methodology. Hazards that are either not detected or are present only at levels below the 1-year MEGs are not considered health threats; therefore, are automatically assigned a low operational risk estimate.

b. Assessment of Ambient Air Particulate Matter. The PM is one of six air pollutants for which the U.S. Environmental Protection Agency (USEPA) has promulgated National Ambient Air Quality Standards in the interest of protecting public health. In addition, the USEPA developed the Air Quality Index (AQI) to communicate daily air quality to the public using six descriptive categories ranging from "good" to "hazardous." The AQI categories for PM are based on concentration ranges that are grouped according to the severity of health concerns. The USACHPPM uses the AQI categories to characterize the operational risk from PM. If any PM sample concentration is above the threshold of the AQI good quality air category, it is identified as a hazard. Hazard severity is determined by comparing the average PM concentration for a specific location and timeframe to PM concentration ranges identified as either negligible or marginal. Negligible concentration levels correspond to mild respiratory effects among generally healthy troops, with more significant effects among sensitive persons, such as, asthmatics or those with existing cardiopulmonary disease. Marginal concentration levels are expected to pose more significant health effects among both healthy personnel, and those with preexisting sensitivities. Hazard probability is based on the frequency that anticipated exposures are above a threshold that is representative of the hazard severity category.

APPENDIX C

INFORMATION SUMMARY
AMBIENT AIR SAMPLES
BUCCA, IRAQ
20 FEBRUARY-29 JUNE 2009

DOEHRS Sample ID	Field/Local Sample ID	Site	Start Date/Time	Sample Duration	Filter ID	Invalid Sample
000012FD	IRQ BUCCA 09051 PM25MV	Burn Pit Tower	2009/02/20 1135	1440.0 minutes	47-08-1510	No
000012FH	IRQ BUCCA 09094 PM25MV	Scrap Metal Yard	2009/04/03 1010	1440.0 minutes	47-08-1513	No
000012FJ	IRQ BUCCA 09105 PM25MV	Scrap Metal Yard	2009/04/14 0957	1440.0 minutes	47-08-1515	No
000012FK	IRQ BUCCA 09115 PM25MV	Scrap Metal Yard	2009/04/24 1100	1446.0 minutes	47-08-1518	No
000012FM	IRQ BUCCA 09122 PM25MV	Scrap Metal Yard	2009/05/01 1040	1440.0 minutes	47-08-1521	No
000012FN	IRQ BUCCA 09129 PM25MV	Scrap Metal Yard	2009/05/08 1000	1140.0 minutes	47-08-1523	No
000012FO	IRQ BUCCA 09136 PM25MV	Scrap Metal Yard	2009/05/15 1136	1440.0 minutes	47-08-1525	No
000012GQ	IRQ BUCCA 09151 PM25MV	Scrap Metal Yard	2009/05/30 1430	1440.0 minutes	47-08-2601	No
000012GS	IRQ BUCCA 09151 PM25MV	Scrap Metal Yard	2009/05/22 1015	1440.0 minutes	47-08-2626	No
000012GV	IRQ BUCCA 09158 PM25MV	Scrap Metal Yard	2009/06/06 1106	1440.0 minutes	47-08-2629	No
000012GX	IRQ BUCCA 09175 PM25MV	Scrap Metal Yard	2009/06/23 1023	1440.0 minutes	47-08-2630	No
000012GZ	IRQ BUCCA 09181 PM25MV	Scrap Metal Yard	2009/06/29 1433	1440.0 minutes	47-08-2631	No
000012FQ	IRQ BUCCA PM25DPS 09052	Burn Pit Tower	2009/02/21 1101	1440.0 minutes	47-08-1511	No
000012GF	IRQ BUCCA PM25DPS 09094	Burn Pit Tower	2009/04/03 1042	1443.0 minutes	47-08-1514	No
000012GH	IRQ BUCCA PM25DPS 09105	Burn Pit Tower	2009/04/14 1010	1449.0 minutes	47-08-1516	No
000012GI	IRQ BUCCA PM25DPS 09115	Burn Pit Tower	2009/04/24 1125	1420.0 minutes	47-08-1517	No

Deployment OEH Risk Characterization, Ambient Air PM Samples, Bucca, Iraq, 20 Feb-29 Jun 09, U_IRQ_BUCCA_CM_A25_20090629

DOEHRS Sample ID	Field/Local Sample ID	Site	Start Date/Time	Sample Duration	Filter ID	Invalid Sample
000012GL	IRQ BUCCA Pm25DPS 09128	Burn Pit Tower	2009/05/08 1014	1458.0 minutes	47-08-1522	No
000012GN	IRQ BUCCA PM25DPS 09136	Burn Pit Tower	2009/05/15 1112	1448.0 minutes	47-08-1524	No
000012H0	IRQ BUCCA PM25DPS 09151	Burn Pit Tower	2009/05/30 1448	1456.0 minutes	47-08-2602	No
000012H1	IRQ BUCCA PM25DPS 09175	Burn Pit Tower	2009/06/23 1102	1440.0 minutes	47-08-2603	No
000012H2	IRQ BUCCA PM25DPS 09187	Burn Pit Tower	2009/06/29 1419	1440.0 minutes	47-08-2604	No
000012H4	IRQ BUCCA PM25DPS 09143	Burn Pit Tower	2009/05/22 1030	1449.0 minutes	47-08-2627	No
000012H5	IRQ BUCCA PM25DPS 09158	Burn Pit Tower	2009/06/06 1120	1455.0 minutes	47-08-2628	No
000012F8	IRQ BUCCA 09082 PM25MV	Scrap Metal Yard	2009/03/28 1408	1440.0 minutes	47-08-1502	Yes
000012H7	IRQ BUCCA PM25DPS 09087	Burn Pit Tower	2009/03/28 1426	1440.0 minutes	47-08-1512	Yes

LEGEND:
DOEHRS Sample ID=Deployment Occupational and Environmental Health Readiness System Sample Identification Number

APPENDIX D

RESULTS SUMMARY
AMBIENT AIR SAMPLES
BUCCA, IRAQ
20 FEBRUARY-29 JUNE 2009

Paramter[1]	Units	Concentration		Valid Samples		USACHPPM TG230 Military Exposure Guideline (MEG) 1 year	
		Maximum	Average[2]	#	# > Laboratory Reporting Limit	# > MEG	MEG
Antimony	µg/m^3	0.73116	0.10329	23	2	0	12
Chromium	µg/m^3	0.070139	0.021484	23	1	0	12
Lead	µg/m^3	0.088646	0.041988	23	2	0	12
Manganese	µg/m^3	0.72917	0.13766	23	2	0	3.4
Nickel	µg/m^3	0.099306	0.024135	23	1	0	37
$PM_{2.5}$	µg/m^3	1642	269	23	23	23	15

[1] Highlighted values indicate the parameter was detected at a concentration above a MEG
[2] Where parameters are not detected in a sample during analyses, half of the laboratory reporting limit is used in the average

LEGEND:
µg/m^3 = micrograms per cubic meter

APPENDIX E

ANALYTICAL SAMPLE RESULTS
AMBIENT AIR SAMPLES
BUCCA, IRAQ
20 FEBRUARY-04 APRIL 2009

DOEHRS Sample ID			000012FD	000012FQ	000012FH	000012GF	000012FJ	000012GH
Field/Local Sample ID			IRQ BUCCA 09051 PM25MV	IRQ BUCCA PM25DPS 09052	IRQ BUCCA 09094 PM25MV	IRQ BUCCA PM25DPS 09094	IRQ BUCCA 09105 PM25MV	IRQ BUCCA PM25DPS 09105
Site			Burn Pit Tower	Burn Pit Tower	Scrap Metal Yard	Burn Pit Tower	Scrap Metal Yard	Burn Pit Tower
Start Date/Time			2009/02/20 1135	2009/02/21 1101	2009/04/03 1010	2009/04/03 1042	2009/04/14 0957	2009/04/14 1010
Parameter	Class	Units	Concentration[1,2]					
Antimony	Metals	µg/m^3	< 0.13915	< 0.069444	< 0.13988	< 0.066000	< 0.14007	< 0.065107
Arsenic	Metals	µg/m^3	< 0.069575	< 0.034722	< 0.069940	< 0.033000	< 0.070036	< 0.032553
Beryllium	Metals	µg/m^3	< 0.069575	< 0.034722	< 0.069940	< 0.033000	< 0.070036	< 0.032553
Cadmium	Metals	µg/m^3	< 0.069575	< 0.034722	< 0.069940	< 0.033000	< 0.070036	< 0.032553
Chromium	Metals	µg/m^3	< 0.069575	0.070139	< 0.069940	< 0.033000	< 0.070036	< 0.032553
Lead	Metals	µg/m^3	< 0.13915	< 0.069444	< 0.13988	< 0.066000	< 0.14007	< 0.065107
Manganese	Metals	µg/m^3	< 0.27830	0.72917	< 0.27976	< 0.13200	< 0.28015	< 0.13021
Nickel	Metals	µg/m^3	< 0.069575	0.099306	< 0.069940	< 0.033000	< 0.070036	< 0.032553
$PM_{2.5}$		µg/m^3	47	1642	84	94	104	149
Vanadium	Metals	µg/m^3	< 0.27830	< 0.13889	< 0.27976	< 0.13200	< 0.28015	< 0.13021
Zinc	Metals	µg/m^3	< 0.69575	< 0.34722	< 0.69940	< 0.33000	< 0.70036	< 0.32553

NOTES:
[1]< X.XX = Below laboratory reporting limit (X.XX)
[2]Laboratory reporting limit is parameter and sample specific

LEGEND:
DOEHRS Sample ID = Deployment Occupational and Environmental Health Readiness System Sample Identification Number
µg/m^3 = micrograms per cubic meter

APPENDIX F

ANALYTICAL SAMPLE RESULTS
AMBIENT AIR SAMPLES
BUCCA, IRAQ
24 APRIL-15 MAY 2009

DOEHRS Sample ID			000012FK	000012GI	000012FM	000012FN	000012GL	000012GN
Field/Local Sample ID			IRQ BUCCA 09115 PM25MV	IRQ BUCCA PM25DPS 09115	IRQ BUCCA 09122 PM25MV	IRQ BUCCA 09129 PM25MV	IRQ BUCCA Pm25DPS 09128	IRQ BUCCA PM25DPS 09136
Site			Scrap Metal Yard	Burn Pit Tower	Scrap Metal Yard	Scrap Metal Yard	Burn Pit Tower	Burn Pit Tower
Start Date/Time			2009/04/24 1100	2009/04/24 1125	2009/05/01 1040	2009/05/08 1000	2009/05/08 1014	2009/05/15 1112
Parameter	Class	Units	Concentration[1,2]					
Antimony	Metals	µg/m^3	< 0.23467	< 0.067069	< 0.13961	< 0.17513	0.73116	< 0.065772
Arsenic	Metals	µg/m^3	< 0.11734	< 0.033535	< 0.069807	< 0.087566	< 0.032352	< 0.032886
Beryllium	Metals	µg/m^3	< 0.11734	< 0.033535	< 0.069807	< 0.087566	< 0.032352	< 0.032886
Cadmium	Metals	µg/m^3	< 0.11734	< 0.033535	< 0.069807	< 0.087566	< 0.032352	< 0.032886
Chromium	Metals	µg/m^3	< 0.11734	< 0.033535	< 0.069807	< 0.087566	< 0.032352	< 0.032886
Lead	Metals	µg/m^3	< 0.23467	< 0.067069	< 0.13961	< 0.17513	0.088646	< 0.065772
Manganese	Metals	µg/m^3	< 0.46934	< 0.13414	< 0.27923	< 0.35026	< 0.12941	0.18614
Nickel	Metals	µg/m^3	< 0.11734	< 0.033535	< 0.069807	< 0.087566	< 0.032352	< 0.032886
$PM_{2.5}$		µg/m^3	198	171	285	173	299	518
Vanadium	Metals	µg/m^3	< 0.46934	< 0.13414	< 0.27923	< 0.35026	< 0.12941	< 0.13154
Zinc	Metals	µg/m^3	< 1.1734	< 0.33535	< 0.69807	< 0.87566	< 0.32352	< 0.32886

NOTES:
[1]< X.XX = Below laboratory reporting limit (X.XX)
[2]Laboratory reporting limit is parameter and sample specific
LEGEND:
DOEHRS Sample ID = Deployment Occupational and Environmental Health Readiness System Sample Identification Number
µg/m^3 = micrograms per cubic meter

APPENDIX G

ANALYTICAL SAMPLE RESULTS
AMBIENT AIR SAMPLES
BUCCA, IRAQ
15 MAY-06 JUNE 2009

DOEHRS Sample ID			000012FO	000012GS	000012H4	000012GQ	000012H0	000012GV
Field/Local Sample ID			IRQ BUCCA 09136 PM25MV	IRQ BUCCA 09151 PM25MV	IRQ BUCCA PM25DPS 09143	IRQ BUCCA 09151 PM25MV	IRQ BUCCA PM25DPS 09151	IRQ BUCCA 09158 PM25MV
Site			Scrap Metal Yard	Scrap Metal Yard	Burn Pit Tower	Scrap Metal Yard	Burn Pit Tower	Scrap Metal Yard
Start Date/Time			2009/05/15 1136	2009/05/22 1015	2009/05/22 1030	2009/05/30 1430	2009/05/30 1448	2009/06/06 1106
Parameter	Class	Units	Concentration[1,2]					
Antimony	Metals	µg/m^3	< 0.13932	< 0.13793	0.10352	< 0.13678	< 0.066040	< 0.13940
Arsenic	Metals	µg/m^3	< 0.069662	< 0.068963	< 0.033179	< 0.068389	< 0.033020	< 0.069702
Beryllium	Metals	µg/m^3	< 0.069662	< 0.068963	< 0.033179	< 0.068389	< 0.033020	< 0.069702
Cadmium	Metals	µg/m^3	< 0.069662	< 0.068963	< 0.033179	< 0.068389	< 0.033020	< 0.069702
Chromium	Metals	µg/m^3	< 0.069662	< 0.068963	< 0.033179	< 0.068389	< 0.033020	< 0.069702
Lead	Metals	µg/m^3	< 0.13932	< 0.13793	< 0.066359	< 0.13678	< 0.066040	< 0.13940
Manganese	Metals	µg/m^3	< 0.27865	< 0.27585	< 0.13272	< 0.27356	< 0.13208	< 0.27881
Nickel	Metals	µg/m^3	< 0.069662	< 0.068963	< 0.033179	< 0.068389	< 0.033020	< 0.069702
$PM_{2.5}$		µg/m^3	360	101	258	106	272	142
Vanadium	Metals	µg/m^3	< 0.27865	< 0.27585	< 0.13272	< 0.27356	< 0.13208	< 0.27881
Zinc	Metals	µg/m^3	< 0.69662	< 0.68963	< 0.33179	< 0.68389	< 0.33020	< 0.69702

[1]< X.XX = Below laboratory reporting limit (X.XX)
[2]Laboratory reporting limit is parameter and sample specific
LEGEND:
DOEHRS Sample ID = Deployment Occupational and Environmental Health Readiness System Sample Identification Number
µg/m^3 = micrograms per cubic meter

APPENDIX H

ANALYTICAL SAMPLE RESULTS
AMBIENT AIR SAMPLES
BUCCA, IRAQ
06 JUNE-29 JUNE 2009

DOEHRS Sample ID			000012H5	000012GX	000012H1	000012H2	000012GZ
Field/Local Sample ID			IRQ BUCCA PM25DPS 09158	IRQ BUCCA 09175 PM25MV	IRQ BUCCA PM25DPS 09175	IRQ BUCCA PM25DPS 09187	IRQ BUCCA 09181 PM25MV
Site			Burn Pit Tower	Scrap Metal Yard	Burn Pit Tower	Burn Pit Tower	Scrap Metal Yard
Start Date/Time			2009/06/06 1120	2009/06/23 1023	2009/06/23 1102	2009/06/29 1419	2009/06/29 1433
Parameter	Class	Units	Concentration[1,2]				
Antimony	Metals	µg/m^3	< 0.068729	< 0.13952	< 0.065514	< 0.069444	< 0.13857
Arsenic	Metals	µg/m^3	< 0.034364	< 0.069762	< 0.032757	< 0.034722	< 0.069286
Beryllium	Metals	µg/m^3	< 0.034364	< 0.069762	< 0.032757	< 0.034722	< 0.069286
Cadmium	Metals	µg/m^3	< 0.034364	< 0.069762	< 0.032757	< 0.034722	< 0.069286
Chromium	Metals	µg/m^3	< 0.034364	< 0.069762	< 0.032757	< 0.034722	< 0.069286
Lead	Metals	µg/m^3	0.072852	< 0.13952	< 0.065514	< 0.069444	< 0.13857
Manganese	Metals	µg/m^3	< 0.13746	< 0.27905	< 0.13103	< 0.13889	< 0.27715
Nickel	Metals	µg/m^3	< 0.034364	< 0.069762	< 0.032757	< 0.034722	< 0.069286
$PM_{2.5}$		µg/m^3	278	132	304	280	184
Vanadium	Metals	µg/m^3	<0.13746	<0.27905	<0.32757	<0.34722	<0.69286
Zinc	Metals	µg/m^3	<0.34364	<0.69762	<0.32757	<0.34722	<0.69286

[1]< X.XX = Below laboratory reporting limit (X.XX)
[2]Laboratory reporting limit is parameter and sample specific
LEGEND:
DOEHRS Sample ID = Deployment Occupational and Environmental Health Readiness System Sample Identification Number
µg/m^3 = micrograms per cubic meter