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

09 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, Kandahar, Afghanistan, 16-28 June 2009, U_AFG_KANDAHAR_CM_A10_20090628

1. The enclosed assessment details the risk characterization for 23 valid ambient air particulate matter (PM) samples collected by 1st Preventive Medicine Detachment personnel at Kandahar, Afghanistan, 16-28 June 2009.

2. The occupational and environmental health risk estimate for exposure to PM less than 10 micrometers in diameter (PM_{10}) and metals in the ambient air at Kandahar, Afghanistan is **moderate** due to elevated levels of PM_{10}. 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

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

DEPLOYMENT OCCUPATIONAL AND ENVIRONMENTAL
HEALTH RISK CHARACTERIZATION
AMBIENT AIR PARTICULATE MATTER SAMPLES
KANDAHAR, AFGHANISTAN
16-28 JUNE 2009
U_AFG_KANDAHAR_CM_A10_20090628

Preventive Medicine Survey: 40-5f1

USCHPPM

Readiness Thru Health

DEPLOYMENT OCCUPATIONAL AND ENVIRONMENTAL
HEALTH RISK CHARACTERIZATION
AMBIENT AIR PARTICULATE MATTER SAMPLES
KANDAHAR, AFGHANISTAN
16-28 JUNE 2009
U_AFG_KANDAHAR_CM_A10_20090628

1. REFERENCES.

a. Department of the Army, Field Manual (FM) 5-19, Composite Risk Management, 21 August 2006.

b. U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) Technical Guide (TG) 230, Chemical Exposure Guidelines for Deployed Military Personnel, Version 1.3, May 2003 with the January 2004 addendum.

c. USACHPPM Reference Document (RD) 230, Chemical Exposure Guidelines for Deployed Military Personnel, Version 1.3, May 2003 with January 2004 addendum.

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

2. PURPOSE. According to U.S. Department of Defense medical surveillance requirements, this occupational and environmental health (OEH) risk characterization documents the identification and assessment of chemical hazards that pose potential health and operational risks to deployed troops. Specifically, the samples and information provided on the associated field data sheets were used to estimate the operational health risk associated with exposure to identified chemical hazards in the air at the Kandahar, Afghanistan.

3. SCOPE. This assessment addresses the analytical results for 23 valid ambient air PM samples collected from Kandahar, Afghanistan, 16-28 June 2009. These samples are limited in time, area, and media. Therefore, this report should not be considered a complete assessment of the overall OEH hazards to which troops may be exposed at Kandahar, Afghanistan. However, this assessment has been performed using operational risk management (ORM) doctrine FM 5-19, and the relatively conservative (protective) assumptions and methods provided in TG 230, to facilitate decision making that can minimize the likelihood of significant risks.

4. BACKGROUND AND EXPOSURE ASSUMPTIONS.

a. General. The samples were collected to assess potential adverse health effects to troops routinely and continuously breathing the ambient air at Kandahar, Afghanistan. Table 1 describes the dates and number of samples collected at each sampling site. Neither significant

weather conditions nor emissions from what would be expected from daily operations were reported. Personnel are expected to remain at this location for more 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.

b. Sample Information. The 23 valid samples represent 12 days. The samples were obtained using a PM less than 10 micrometers in diameter (PM_{10}) sample head and the Deployable Particulate Sampler (DPS™) at four sites. (DPS™ is a trademark of SKC Inc.).

Table 1. Sample Count and Site Summary, Kandahar, Afghanistan, 16-28 June 2009

Sample Site	Dates Sampled	Number Collected	Number Valid	Number Invalid
Morale, Welfare, and Recreation (MWR) Center	16-21 Jun 09	6	6	0
South Park	16-21 Jun 09	5	5	0
Boardwalk	16-21 Jun 09	6	6	0
Burn Pit	22-28 Jun 09	6	6	0
All	16-28 Jun 09	23	23	0

5. METHOD.

a. General. The USACHPPM Deployment Environmental Surveillance Program (DESP) uses the TG 230 methodology 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, 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 one time or intermittent exposures. The underlying toxicological basis for the MEGs is addressed in the 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 and, 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 (NAAQS) 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 pre-existing sensitivities. Hazard probability is based on the frequency that anticipated exposures are above a threshold that is representative of the hazard severity category.

6. HAZARD IDENTIFICATION.

a. Laboratory Analysis. All samples were analyzed for PM_{10} and metals. Detected metals identified above the laboratory reportable limit were compared to MEGs presented in TG 230, while PM_{10} concentrations were assessed using the process described in the Method section, paragraph 5. Appendix A shows an information summary of the samples assessed in this report. Appendix B shows a sample results summary table for detected parameters in all samples collected at Kandahar, Afghanistan. Appendices C through F show sample results summary tables for detected parameters in samples collected by sampling site. Appendices G through J show complete analytical results for the individual samples.

b. Assessment.

(1) The PM. Since the PM_{10} was measured at concentrations above the AQI "good" range, PM_{10} 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; for example, 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. Primary sources of PM_{10} at the specified location are assumed to be windblown dust and sand.

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

7. HAZARD ASSESSMENT.

a. Hazard Severity.

(1) General. The hazard severity for the potential health threat of concern was determined by comparison of PM_{10} concentrations to the AQI and using the process described in the Method section, paragraph 5. In this sampling event, the average PM_{10} concentration was determined for each day when two or more samples were collected on any given day. During this sampling event, samples were collected from four sites over 12 days. Table 2 summarizes averaged PM_{10} concentrations by day and by site.

Table 2. Daily Averaged PM_{10} Concentrations from Kandahar, Afghanistan, 16-28 June 2009

Date	MWR	South Park	Boardwalk	Burn Pit	**Average**
16-Jun	308	361	180	N/A	**283**
17-Jun	383	213	N/A	N/A	**298**
18-Jun	432	446	334[1]	N/A	**404**
19-Jun	350	N/A	336	N/A	**343**
20-Jun	317	182	307	N/A	**269**
21-Jun	268	131	237	N/A	**212**
22-Jun	N/A	N/A	N/A	660	**660**
23-Jun	N/A	N/A	N/A	536	**536**
25-Jun	N/A	N/A	N/A	302	**302**
26-Jun	N/A	N/A	N/A	275	**275**
27-Jun	N/A	N/A	N/A	394	**394**
28-Jun	N/A	N/A	N/A	357	**357**
Average	**343**	**267**	**271**	**421**	**360**

NOTE:
[1]Two samples were collected from this site on this day so this is an averaged value

LEGEND:
N/A = No sample collected

(2) The PM_{10}. The average PM_{10} concentration for all 12 days was 360 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 (e.g. lost duty days), particularly if 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. Although the average PM_{10} sample concentration was in a range considered to be of marginal severity, it is important to examine the individual samples to determine whether the average concentration is dominated by outliers or if it is representative of a typical exposure. 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 severity category (350 $\mu g/m^3$). During this 12 day sampling event, the range of daily averaged PM_{10} sample concentrations was 212-660 $\mu g/m^3$, and 5 of 12 (42 percent) samples were above 350 $\mu g/m^3$. Since the assumption is that all or most personnel at this location are equally exposed to the ambient air, the probability that personnel will be exposed to PM_{10} concentrations greater than 350 $\mu g/m^3$ is considered occasional.

c. Risk Estimate and Confidence. The hazard severity and probability levels described above were used with the ORM matrix in TG 230, Table 3-3, or FM 5-19 to provide a risk estimate for exposure to each identified hazard. Table 3 summarizes the risk estimate for each identified hazard. The risk estimate for exposure to the ambient air at Kandahar, Afghanistan is considered **moderate** due to elevated levels of PM_{10}. Confidence in the risk estimate is considered **medium**. In general, the confidence level in risk estimates is usually low to medium due to consistent lack of specific exposure information associated with troop movement and activity patterns; other routes/sources of potential OEH hazards not identified; and uncertainty regarding impacts of multiple chemicals present, particularly those affecting the same body organs/systems.

Table 3. Risk Estimate Summary for Exposure to Ambient Air at Kandahar, Afghanistan, 16-28 June 2009

Parameter	Hazard Severity	Hazard Probability	Hazard-Specific Risk Estimate	Operational Risk Estimate	Confidence
PM_{10}	MARGINAL	OCCASIONAL	MODERATE	MODERATE	MEDIUM
Metals	No parameters detected above a MEG		LOW		

8. CONCLUSION. The OEH risk estimate for exposure to PM_{10} and metals in the ambient air at Kandahar, Afghanistan is **moderate** due to elevated levels PM_{10}. 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. Confidence in the risk estimate is considered medium.

9. RECOMMENDATIONS AND NOTES.

a. Recommendations.

(1) Attempt to collect PM_{10} and PM less than 2.5 microns in diameter ($PM_{2.5}$), if the sample heads are available, at least once every 6 days for the deployment duration (or as long as possible) to better characterize the $PM_{2.5,}$ $PM_{10,}$ and metals ambient air concentrations to which personnel are typically exposed.

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

(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 in the Background and exposure Assumptions, paragraph 4, and the sample results assessed in this report. If the assumed exposure scenario changes, provide 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://doehsportal.apgea.army.mil/doehrs-oehs/. If you have additional DOEHS data for this location it can also be submitted via this Web site.

10. POINTS OF CONTACT. The USACHPPM points of contact for this assessment are Mr. (b) (6) and Mr. (b) (6). Mr. (b) (6) may be contacted at e-mail (b) (6); Mr. (b) (6) 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

INFORMATION SUMMARY
AMBIENT AIR PARTICULATE MATTER SAMPLES
KANDAHAR, AFGHANISTAN
16-28 JUNE 2009

DOEHRS Sample ID	Site	Start Date/Time	Sample Duration	Filter ID
0000136R	Morale Welfare and Recreation	2009/06/16 1407	1440.0 minutes	47-09-0757
0000137A	Boardwalk	2009/06/16 1442	1440.0 minutes	47-09-0753
00001370	South Park	2009/06/16 1536	1440.0 minutes	47-09-0760
0000136U	Morale Welfare and Recreation	2009/06/17 1620	1440.0 minutes	47-09-0754
00001372	South Park	2009/06/17 1711	1440.0 minutes	47-09-0778
0000137E	Boardwalk	2009/06/18 1010	1440.0 minutes	47-09-0782
0000136V	Morale Welfare and Recreation	2009/06/18 1028	1440.0 minutes	47-09-0781
00001376	South Park	2009/06/18 1100	1440.0 minutes	47-09-0785
0000137C	Boardwalk	2009/06/18 1615	1440.0 minutes	47-09-0776
0000137F	Boardwalk	2009/06/19 1110	1440.0 minutes	47-09-0788
0000136W	Morale Welfare and Recreation	2009/06/19 1150	1440.0 minutes	47-09-0789
0000136X	Morale Welfare and Recreation	2009/06/20 1150	1440.0 minutes	47-09-0763
00001377	South Park	2009/06/20 1340	1440.0 minutes	47-09-0761
0000137G	Boardwalk	2009/06/20 1520	1440.0 minutes	47-09-0764
0000137H	Boardwalk	2009/06/21 1634	1440.0 minutes	47-09-0791
0000136Y	Morale Welfare and Recreation	2009/06/21 1730	1440.0 minutes	47-09-0794
00001378	South Park	2009/06/21 1817	1440.0 minutes	47-09-0765
000010EU	Burn Pit	2009/06/22 1700	1440.0 minutes	47-09-0790
000010EN	Burn Pit	2009/06/23 1723	1440.0 minutes	47-09-0758
000010EP	Burn Pit	2009/06/25 1053	1440.0 minutes	47-09-0766

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DOEHRS Sample ID	Site	Start Date/Time	Sample Duration	Filter ID
000010ER	Burn Pit	2009/06/26 1120	1440.0 minutes	47-09-0767
000010ET	Burn Pit	2009/06/27 1155	1440.0 minutes	47-09-0792
000010ES	Burn Pit	2009/06/28 1200	1440.0 minutes	47-09-0768

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

APPENDIX B

RESULTS SUMMARY
AMBIENT AIR PARTICULATE MATTER SAMPLES
KANDAHAR, AFGHANISTAN
16-28 JUNE 2009

Parameter[1]	Units	Concentration		Valid Samples		USACHPPM TG230 Military Exposure Guidelines (MEGs) 1 year	
		Maximum	Average[2]	#	# > Laboratory Reporting Limit	> MEG	MEG
Antimony	µg/m^3	0.084758	0.037274	23	1	0	12
Lead	µg/m^3	0.18031	0.048743	23	4	0	12
Manganese	µg/m^3	0.26084	0.11255	23	8	0	3.4
PM_{10}	µg/m^3	660	360	23	23	23	50

NOTES:
[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 C

RESULTS SUMMARY
AMBIENT AIR PARTICULATE MATTER SAMPLES
MORALE WELFARE AND RECREATION CENTER,
KANDAHAR, AFGHANISTAN
16-21 JUNE 2009

Parameter[1]	Units	Concentration		Valid Samples		USACHPPM TG230 Military Exposure Guidelines (MEGs)	
						1 year	
		Maximum	Average[2]	#	# > Laboratory Reporting Limit	> MEG	MEG
Manganese	µg/m^3	0.21157	0.10882	6	2	0	3.4
PM_{10}	µg/m^3	432	343	6	6	6	50

NOTES:
[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 D

RESULTS SUMMARY
AMBIENT AIR PARTICULATE MATTER SAMPLES
SOUTH PARK, KANDAHAR, AFGHANISTAN
16-21 JUNE 2009

Parameter[1]	Units	Concentration		Valid Samples		USACHPPM TG230 Military Exposure Guidelines (MEGs)	
						1 year	
		Maximum	Average[2]	#	# > Laboratory Reporting Limit	> MEG	MEG
Manganese	µg/m^3	0.26084	0.12688	5	2	0	3.4
PM_{10}	µg/m^3	446	267	5	5	5	50

NOTES:
[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

RESULTS SUMMARY
AMBIENT AIR PARTICULATE MATTER SAMPLES
BOARDWALK, KANDAHAR, AFGHANISTAN
16-21 JUNE 2009

Parameter[1]	Units	Concentration[2]		Valid Samples		USACHPPM TG230 Military Exposure Guidelines (MEGs)	
						1 year	
		Maximum	Average	#	# > Laboratory Reporting Limit	> MEG	MEG
Lead	µg/m^3	0.18031	0.071945	6	2	0	12
Manganese	µg/m^3	0.19792	0.10268	6	2	0	3.4
PM_{10}	µg/m^3	368	271[3]	6	6	6	50

NOTES:
[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
[3] Concentration represents the average concentration when two samples were collected on the same day

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

APPENDIX F

RESULTS SUMMARY
AMBIENT AIR PARTICULATE MATTER SAMPLES
BURN PIT, KANDAHAR, AFGHANISTAN
22-28 JUNE 2009

Parameter[1]	Units	Concentration[2]		Valid Samples		USACHPPM TG230 Military Exposure Guidelines (MEGs) 1 year	
		Maximum	Average	#	# > Laboratory Reporting Limit	> MEG	MEG
Antimony	µg/m^3	0.084758	0.043973	6	1	0	12
Lead	µg/m^3	0.084602	0.050418	6	2	0	12
Manganese	µg/m^3	0.2037	0.11421	6	2	0	3.4
PM_{10}	µg/m^3	660	421	6	6	6	50

NOTES:
[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 G

ANALYTICAL SAMPLE RESULTS
AMBIENT AIR PARTICULATE MATTER SAMPLES
KANDAHAR, AFGHANISTAN
16-18 JUNE 2009

DOEHRS Sample ID			0000136R	00001370	0000137A	00001372	0000136U	0000136V	00001376
Field/Local Sample ID			AFG_KANDAH_09167_PM10DPS	AFG_KANDAH_09167_PM10DPS_1	AFG_KANDAH_09167_PM10DPS_2	AFG_KANDAH_09168_PM10DPS_1	AFG_KANDAH_09168_PM10DPS	AFG_KANDAH_09168_PM10DPS	AFG_KANDAH_09169_PM10DPS_1
Site			Morale Welfare and Recreation	South Park	Boardwalk	South Park	Morale Welfare and Recreation	Morale Welfare and Recreation	South Park
Start Date/Time			2009/06/16 1407	2009/06/16 1536	2009/06/16 1442	2009/06/17 1711	2009/06/17 1620	2009/06/18 1028	2009/06/18 1100
Parameter	Class	Units	Concnetartion[1,2]						
Antimony	Metals	µg/m^3	< 0.074272	< 0.078367	< 0.056459	< 0.069793	< 0.065514	< 0.071963	< 0.067751
Arsenic	Metals	µg/m^3	< 0.037136	< 0.039183	< 0.028229	< 0.034897	< 0.032757	< 0.035982	< 0.033875
Beryllium	Metals	µg/m^3	< 0.037136	< 0.039183	< 0.028229	< 0.034897	< 0.032757	< 0.035982	< 0.033875
Cadmium	Metals	µg/m^3	< 0.037136	< 0.039183	< 0.028229	< 0.034897	< 0.032757	< 0.035982	< 0.033875
Chromium	Metals	µg/m^3	< 0.037136	< 0.039183	< 0.028229	< 0.034897	< 0.032757	< 0.035982	< 0.033875
Lead	Metals	µg/m^3	< 0.074272	< 0.078367	< 0.056459	< 0.069793	< 0.065514	< 0.071963	< 0.067751
Manganese	Metals	µg/m^3	< 0.14854	0.17006	< 0.11292	< 0.13959	0.15461	0.21157	0.26084
Nickel	Metals	µg/m^3	< 0.037136	< 0.039183	< 0.028229	< 0.034897	< 0.032757	< 0.035982	< 0.033875
PM_{10}		µg/m^3	308	361	180	213	383	432	446
Vanadium	Metals	µg/m^3	< 0.14854	< 0.15673	< 0.11292	< 0.13959	< 0.13103	< 0.14393	< 0.13550
Zinc	Metals	µg/m^3	< 0.37136	< 0.39183	< 0.28229	< 0.34897	< 0.32757	< 0.35982	< 0.33875

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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 H

ANALYTICAL SAMPLE RESULTS
AMBIENT AIR PARTICULATE MATTER SAMPLES
KANDAHAR, AFGHANISTAN
18-20 JUNE 2009

DOEHRS Sample ID			0000137C	0000137E	0000136W	0000137F	0000137G	0000136X	00001377
Field/Local Sample ID			AFG_KANDAH_09167_PM10DPS_2	AFG_KANDAH_09169_PM10DPS_2	AFG_KANDAH_09168_PM10DPS	AFG_KANDAH_09170_PM10DPS_2	AFG_KANDAH_09171_PM10DPS_2	AFG_KANDAH_09168_PM10DPS	AFG_KANDAH_09171_PM10DPS_1
Site			Boardwalk	Boardwalk	Morale Welfare and Recreation	Boardwalk	Boardwalk	Morale Welfare and Recreation	South Park
Start Date/Time			2009/06/18 1615	2009/06/18 1010	2009/06/19 1150	2009/06/19 1110	2009/06/20 1520	2009/06/20 1150	2009/06/20 1340
Parameter	Class	Units	Concnetartion[1,2]						
Antimony	Metals	µg/m^3	< 0.081222	< 0.069444	< 0.071963	< 0.067751	< 0.070146	< 0.073099	< 0.069099
Arsenic	Metals	µg/m^3	< 0.040611	< 0.034722	< 0.035982	< 0.033875	< 0.035073	< 0.036550	< 0.034549
Beryllium	Metals	µg/m^3	< 0.040611	< 0.034722	< 0.035982	< 0.033875	< 0.035073	< 0.036550	< 0.034549
Cadmium	Metals	µg/m^3	< 0.040611	< 0.034722	< 0.035982	< 0.033875	< 0.035073	< 0.036550	< 0.034549
Chromium	Metals	µg/m^3	< 0.040611	< 0.034722	< 0.035982	< 0.033875	< 0.035073	< 0.036550	< 0.034549
Lead	Metals	µg/m^3	0.18031	0.12014	< 0.071963	< 0.067751	< 0.070146	< 0.073099	< 0.069099
Manganese	Metals	µg/m^3	< 0.16244	0.19792	< 0.14393	0.14228	< 0.14029	< 0.14620	< 0.13820
Nickel	Metals	µg/m^3	< 0.040611	< 0.034722	< 0.035982	< 0.033875	< 0.035073	< 0.036550	< 0.034549
PM_{10}		µg/m^3	300	368	350	336	307	317	182
Vanadium	Metals	µg/m^3	< 0.16244	< 0.13889	< 0.14393	< 0.13550	< 0.14029	< 0.14620	< 0.13820
Zinc	Metals	µg/m^3	< 0.40611	< 0.34722	< 0.35982	< 0.33875	< 0.35073	< 0.36550	< 0.34549

Deployment OEH Risk Characterization, Ambient Air PM Samples, Kandahar, Afghanistan, 16-28 Jun 09, U_AFG_KANDAHAR_CM_A10_20090628

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 I

ANALYTICAL SAMPLE RESULTS
AMBIENT AIR PARTICULATE MATTER SAMPLES
KANDAHAR, AFGHANISTAN
21-26 JUNE 2009

DOEHRS Sample ID			0000137H	00001378	0000136Y	000010EU	000010EN	000010EP	000010ER
Field/Local Sample ID			AFG_KANDAH_09171_PM10DPS_2	AFG_KANDAH_09172_PM10DPS_1	AFG_KANDAH_09168_PM10DPS	AFG KANDAH 09173 PM10DPS	AFGH KANDAH 09174 PM10DPS	AFH KANDAH 09176 PM10DPS	AFG KANDAH 09177 PM10DPS
Site			Boardwalk	South Park	Morale Welfare and Recreation	Burn Pit	Burn Pit	Burn Pit	Burn Pit
Start Date/Time			2009/06/21 1634	2009/06/21 1817	2009/06/21 1730	2009/06/22 1700	2009/06/23 1723	2009/06/25 1053	2009/06/26 1120
Parameter	Class	Units	Concnetartion[1,2]						
Antimony	Metals	µg/m^3	< 0.068083	< 0.064599	< 0.067422	< 0.070502	0.084758	< 0.072338	< 0.070502
Arsenic	Metals	µg/m^3	< 0.034041	< 0.032300	< 0.033711	< 0.035251	< 0.035613	< 0.036169	< 0.035251
Beryllium	Metals	µg/m^3	< 0.034041	< 0.032300	< 0.033711	< 0.035251	< 0.035613	< 0.036169	< 0.035251
Cadmium	Metals	µg/m^3	< 0.034041	< 0.032300	< 0.033711	< 0.035251	< 0.035613	< 0.036169	< 0.035251
Chromium	Metals	µg/m^3	< 0.034041	< 0.032300	< 0.033711	< 0.035251	< 0.035613	< 0.036169	< 0.035251
Lead	Metals	µg/m^3	< 0.068083	< 0.064599	< 0.067422	0.084602	0.074074	< 0.072338	< 0.070502
Manganese	Metals	µg/m^3	< 0.13617	< 0.12920	< 0.13484	0.19388	0.2037	< 0.14468	< 0.14100
Nickel	Metals	µg/m^3	< 0.034041	< 0.032300	< 0.033711	< 0.035251	< 0.035613	< 0.036169	< 0.035251
PM_{10}		µg/m^3	237	131	268	660	536	302	275
Vanadium	Metals	µg/m^3	< 0.13617	< 0.12920	< 0.13484	< 0.14100	< 0.14245	< 0.14468	< 0.14100
Zinc	Metals	µg/m^3	< 0.34041	< 0.32300	< 0.33711	< 0.35251	< 0.35613	< 0.36169	< 0.35251

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
$\mu g/m^3$ = micrograms per cubic meter

APPENDIX J

ANALYTICAL SAMPLE RESULTS
AMBIENT AIR PARTICULATE MATTER SAMPLES
KANDAHAR, AFGHANISTAN
27 AND 28 JUNE 2009

		DOEHRS Sample ID	000010ET	000010ES
		Field/Local Sample ID	AFG KANDAH 09178 PM10DPS	AFG KANDAH 09179 PM10DPS
		Site	Burn Pit	Burn Pit
		Start Date/Time	2009/06/27 1155	2009/06/28 1200
Parameter	Class	Units	Concnetartion[1,2]	
Antimony	Metals	µg/m^3	< 0.070146	< 0.074671
Arsenic	Metals	µg/m^3	< 0.035073	< 0.037336
Beryllium	Metals	µg/m^3	< 0.035073	< 0.037336
Cadmium	Metals	µg/m^3	< 0.035073	< 0.037336
Chromium	Metals	µg/m^3	< 0.035073	< 0.037336
Lead	Metals	µg/m^3	< 0.070146	< 0.074671
Manganese	Metals	µg/m^3	< 0.14029	< 0.14934
Nickel	Metals	µg/m^3	< 0.035073	< 0.037336
PM_{10}		µg/m^3	394	357
Vanadium	Metals	µg/m^3	< 0.14029	< 0.14934
Zinc	Metals	µg/m^3	< 0.35073	< 0.37336

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