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

MCHB-TS-RDE

SEP 1 0 2009

MEMORANDUM FOR Office 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, Taqaddum, Iraq, 15-16 June 2009, U_IRQ_TAQADDUM_CM_A25_20090616

1. The enclosed assessment details the risk characterization for three ambient air samples collected by 2nd Marine Logistics Group Forward Preventive Medicine personnel at Taqaddum, Iraq, 15-16 June 2009. One sample was invalid due to a flow differential.

2. The occupational and environmental health risk estimate for exposure to particulate matter less than 2.5 micrometer in diameter ($PM_{2.5}$) and metals in the ambient air during this sampling event at Taqaddum, Iraq is **moderate** due to elevated levels of $PM_{2.5}$. Exposure to the ambient air on days with similar conditions may degrade unit readiness and the ability to accomplish the mission to standard if the conditions occur during the mission.

FOR THE COMMANDER:

(b) (6)

Director, Health Risk Management

Encl

CF: (w/encl)
TQ EHO Base Ops (Environmental Health Officer/LT (b) (6)
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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
TAQADDUM, IRAQ
15-16 JUNE 2009
U_IRQ_TAQADDUM_CM_A25_20090616

Preventive Medicine Survey: 40-5f1

USCHPPM

Readiness Thru Health

DEPLOYMENT OCCUPATIONAL AND ENVIRONMENTAL
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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 Taqaddum, Iraq.

3. SCOPE. This assessment addresses the analytical results for three ambient air particulate matter (PM) samples collected from Taqaddum, Iraq, 15-16 June 2009. Two valid PM less than 2.5 micrometers in diameter ($PM_{2.5}$) samples were submitted. 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 Taqaddum, Iraq. 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. The samples were collected to assess the potential for adverse health effects to troops routinely and continuously breathing the ambient air at Taqaddum, Iraq. The samples were collected near the burn pit. The burn pit was active during the sampling period. No industry or significant weather conditions were reported.

Up to 50 percent of 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.

5. METHOD.

a. General. The USACHPPM Deployment Environmental Surveillance Program 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 and probability, and 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. Sample Information. Three ambient air PM samples were collected with the DPS™ apparatus. One sample was invalid due to a flow differential. (DPS™ is a trademark of SKC, Inc.)

b. Laboratory Analysis. The samples were analyzed for $PM_{2.5}$ and metals. Detected metals identified above the laboratory reportable limit were compared to MEGs presented in TG 230, while $PM_{2.5}$ concentrations were assessed using the process described in the Method, section 5. Appendix A shows a summary of the samples assessed in this report. Appendix B shows a sample results summary table. Appendix C shows complete analytical results for individual samples.

c. Assessment.

(1) The PM. Since the $PM_{2.5}$ was measured at concentrations above the AQI "good" range, $PM_{2.5}$ is identified as potential health threats 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 $PM_{2.5}$ 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. The hazard severity for the potential health threats of concern was determined by comparison of $PM_{2.5}$ concentrations to the AQI and using the process described in the Method, section 5. The average concentration of $PM_{2.5}$ was 648 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 for both $PM_{2.5}$ is considered marginal.

b. Hazard Probability. The hazard probability reflects the likelihood that the exposures at this location are represented by the concentrations used to determine the hazard severity. Using TG 230 methodology and Reference 1d to estimate the hazard probability for PM when only a small number of samples/number of days sampled are assessed often results in a risk estimate that is not consistent with actual exposure outcomes. Until a more refined assessment method can be published in TG 230, the method USACHPPM Deployment Environmental Surveillance Program currently uses to characterize the risk from PM deviates slightly from TG 230 and Reference 1d. When less than four samples/number of days sampled are received for risk characterization, a hazard probability is not estimated; the hazard severity determines the risk estimate. A negligible severity represents a low risk and a marginal severity represents a moderate risk. Since the hazard severity was estimated to be marginal for the $PM_{2.5}$ in the ambient air during this sampling event, the risk estimate is assumed to be **moderate**.

c. Risk Estimate and Confidence.

(1) Risk Estimate. When applicable, 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 1 summarizes the risk estimate for each identified hazard. The operational risk estimate for Taqaddum, Iraq during this sampling event is based on the highest hazard-specific risk estimate. The risk estimate for this location during this sampling event is **moderate**.

(2) Confidence. Using TG 230, Table 3-5 as a guide, confidence in the risk estimate is considered low. 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 1. Risk Estimate Summary for Exposure to Ambient Air PM at Taqaddum, Iraq, 15-16 June 2009

Parameter	Hazard Severity	Hazard Probability	Hazard-Specific Risk Estimate	Operational Risk Estimate	Confidence
$PM_{2.5}$	MARGINAL	N/A	MODERATE	MODERATE	LOW
Metals	No parameters detected above a MEG		LOW		

LEGEND:
N/A = Not applicable; hazard probability not estimated when < four samples received for risk characterization

8. CONCLUSION. The occupational and environmental health risk estimate for exposure to $PM_{2.5}$ and metals in the ambient air at Taqaddum, Iraq is **moderate** due to elevated levels of $PM_{2.5}$. Exposure to the ambient air on days with similar conditions may degrade unit readiness and the ability to accomplish the mission to standard if the conditions occur during the mission.

9. RECOMMENDATIONS AND NOTE.

a. Recommendations.

(1) Continue to collect samples from this location 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. Note. 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, 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.

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

INFORMATION SUMMARY
AMBIENT AIR PARTICULATE MATTER SAMPLES
TAQADDUM, IRAQ
15-16 JUNE 2009

DOEHRS Sample ID	Field/Local Sample ID	Site	Start Date/Time	Sample Duration	Invalid Sample	Filter ID
00000ZLA	IRQ TAQADD 09166 PM25DPS	Base Burn Pit	2009/06/15 1006	1440.0 minutes	No	47-09-0576
00000ZLE	IRQ TAQADD 09167 PM25DPS	Base Burn Pit	2009/06/16 1030	1440.0 minutes	No	47-09-0577

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

APPENDIX B

RESULTS SUMMARY
AMBIENT AIR PARTICULATE MATTER SAMPLES
TAQADDUM, IRAQ
15-16 JUNE 2009

Parameter[1]	Units	Concentration		Valid Samples		USACHPPM TG230 Military Exposure Guidelines (MEGs)	
						1 year	
		Maximum	Average	#	# > Laboratory Reporting Limit	# > MEG	MEG
Antimony	µg/m^3	0.28264	0.15868	2	1	0	12
Lead	µg/m^3	0.38681	0.21076	2	1	0	12
$PM_{2.5}$	µg/m^3	993	648	2	2	2	15

NOTE:
[1] Highlighted values indicate the parameter was detected at a concentration above a MEG

LEGEND
µg/m^3 = micrograms per cubic meter

APPENDIX C

ANALYTICAL SAMPLE RESULTS
AMBIENT AIR PARTICULATE MATTER SAMPLES
TAQADDUM, IRAQ
15-16 JUNE 2009

DOEHRS Sample ID			00000ZLA	00000ZLE
Field/Local Sample ID			IRQ TAQADD 09166 PM25DPS	IRQ TAQADD 09167 PM25DPS
Site			Base Burn Pit	Base Burn Pit
Start Date/Time			2009/06/15 1006	2009/06/16 1030
Parameter	Class	Units	Concentration[1,2]	
Antimony	Metals	µg/m^3	< 0.069444	0.28264
Arsenic	Metals	µg/m^3	< 0.034722	< 0.034722
Beryllium	Metals	µg/m^3	< 0.034722	< 0.034722
Cadmium	Metals	µg/m^3	< 0.034722	< 0.034722
Chromium	Metals	µg/m^3	< 0.034722	< 0.034722
Lead	Metals	µg/m^3	< 0.069444	0.38681
Manganese	Metals	µg/m^3	< 0.13889	< 0.13889
Nickel	Metals	µg/m^3	< 0.034722	< 0.034722
$PM_{2.5}$		µg/m^3	304	993
Vanadium	Metals	µg/m^3	< 0.13889	< 0.13889
Zinc	Metals	µg/m^3	< 0.34722	< 0.34722

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