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US ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
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MCHB-TS-RDE

MEMORANDUM FOR Command Surgeon (MAJ (b) (6)) U.S. 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, Sykes, Iraq, 10-14 August 2008,
U_IRQ_SYKES_CM_A10-25_20080814

1. The enclosed assessment details the risk characterization for nine ambient air samples collected by 926th Medical Detachment – Preventive Medicine personnel at Sykes, Iraq, 10-14 August 2008. One additional sample was invalid due to sampler malfunction.
2. The occupational and environmental health risk estimate for exposure to particulate matter less than 2.5 and 10 micrometers in diameter (PM_{2.5} and PM₁₀) and metals in the ambient air at Sykes, Iraq is **moderate**. Exposure to the ambient air may have a significant impact on unit readiness if the hazard occurs during the mission.

FOR THE COMMANDER:

(b) (6)

Encl

(b) (6)

Director, Health Risk Management

MCHB-TS-RDE

SUBJECT: Deployment Occupational and Environmental Health Risk Characterization,
Ambient Air Particulate Matter Samples, Sykes, Iraq, 10–14 August 2008,
U_IRQ_SYKES_CM_A10-25_20080814

CF: (w/encl)

1863rd MED DET (MAJ (b) (6))
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MNC-I (Command Surgeon/LTC (b) (6))
MNFI CJ148 (Commander/CDR (b) (6))
ARCENT (Command Surgeon/MAJ (b) (6))
CFLCC (Command Surgeon/MAJ (b) (6))
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U.S. Army Center for Health Promotion and Preventive Medicine

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DEPLOYMENT OCCUPATIONAL AND ENVIRONMENTAL
HEALTH RISK CHARACTERIZATION
AMBIENT AIR PARTICULATE MATTER SAMPLES
SYKES, IRAQ
10-14 AUGUST 2008
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DEPLOYMENT OCCUPATIONAL AND ENVIRONMENTAL
HEALTH RISK CHARACTERIZATION
AMBIENT AIR PARTICULATE MATTER SAMPLES
SYKES, IRAQ
10–14 AUGUST 2008
U_IRQ_SYKES_CM_A10-25_20080814

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 August 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 Sykes, Iraq.

3. **SCOPE.** This assessment addresses the analytical results for nine valid ambient air samples collected from Sykes, Iraq, 10–14 August 2008. 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 this location. 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 Sykes, Iraq. Four valid samples of PM less than 2.5 micrometers in diameter (PM_{2.5}) and five PM less than 10 micrometers in diameter (PM₁₀) were collected from the burn pit area. It was noted that the burn pit was not in operation at the start of sampling but did occur

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later during the sampling period. Light winds were reported each day with a maximum speed of 8 miles per hour. Most of the personnel in this area are expected to be exposed to the air. Personnel are expected to remain at this location for a exposure duration of 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.

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. Nine valid samples were collected with the Mini-Vol™ apparatus. Four samples were PM_{2.5} and five samples were PM₁₀. The fifth PM_{2.5} sample was invalid due to sampler malfunction. (Mini-Vol™ is a registered trademark of Airmetrics.)

b. Laboratory Analysis. All samples were analyzed for PM_{2.5} or PM₁₀, and metals. Detected metals identified above the laboratory reportable limit were compared to MEGs presented in TG 230, while PM_{2.5} and PM₁₀ concentrations were assessed using the process described in the Method section, paragraph 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 Particulate Matter. Since both the PM_{2.5} and PM₁₀ were measured at concentrations above the AQI “good” range, PM_{2.5} and PM₁₀ are 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} and PM₁₀ 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} and PM₁₀ concentrations to the AQI and using the process described in the Method section, paragraph 5. The average concentration of PM_{2.5} was 107 micrograms per cubic meter (µg/m³) and the average PM₁₀ concentration was 339 µg/m³. These concentrations fall within the ranges of concentrations that are believed to pose significant health concerns to susceptible groups, which in the military can include asthmatics or persons

with pre-existing cardiopulmonary disease. Otherwise, generally healthy troops may have some eye, nasal, or throat irritation causing little or no impact on unit readiness. Therefore, the hazard severity for both PM_{2.5} and PM₁₀ is considered **negligible**.

b. Hazard Probability. Although the average PM_{2.5} and PM₁₀ sample concentrations were within the negligible severity range, it is important to examine the individual samples to determine whether the average concentrations are dominated by outliers or if they are representative of typical exposures. The hazard probability reflects the likelihood that the exposures at the location are represented by the concentrations used to determine the hazard severity.

(1) The PM_{2.5}. The probability that the severity of a hazard is negligible is based on a comparison of individual sample concentrations to the PM_{2.5} 24-hour NAAQS of 35 µg/m³. During this sampling event, the range of PM_{2.5} concentration was 72–127 µg/m³; therefore, all PM_{2.5} samples were above 35 µg/m³. 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_{2.5} concentrations above 35 µg/m³ is considered **frequent**.

(2) The PM₁₀. The probability that the severity of a hazard is marginal is based on a comparison of individual sample concentrations to the PM₁₀ 24-hour NAAQS of 150 µg/m³. During this sampling event, the range of PM₁₀ sample concentrations was 234–422 µg/m³; therefore, all samples were above 150 µg/m³. 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 PM₁₀ concentrations greater than 150 µg/m³ is considered **frequent**.

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 1 summarizes the risk estimate for each identified hazard. The risk estimate for Sykes, Iraq is considered **moderate**. The risk estimate for exposure to the ambient air at this location is based on the highest identified hazard risk estimate (PM_{2.5} and PM₁₀). Confidence in the risk estimate is considered **low** because it is unclear if the samples represent conditions to which personnel are typically exposed for the deployment duration. 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 PM in the Ambient Air at Sykes, Iraq

Parameter	Hazard Severity	Hazard Probability	Hazard-Specific Risk Estimate	Operational Risk Estimate	Confidence
PM _{2.5}	NEGLIGIBLE	FREQUENT	MODERATE	MODERATE	LOW
PM ₁₀	NEGLIGIBLE	FREQUENT	MODERATE		
Metals	No parameters detected above a MEG		LOW		

8. **CONCLUSION.** The OEH risk estimate for exposure to PM_{2.5}, PM₁₀, and metals in the ambient air at Sykes, Iraq is **moderate** due to PM_{2.5} and PM₁₀. Exposure to the ambient air may have a significant impact on unit readiness of the hazard occurs 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}, PM₁₀, 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 PM_{2.5}, PM₁₀, metals, and volatile organic compounds, etc. in the air and address appropriately in medical surveillance and health risk communication activities.

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.

Deployment OEH Risk Characterization, Ambient Air PM Samples, Sykes, Iraq, 10–14 Aug 08,
U_IRQ_SYKES_CM_A10-25_20080814

10. POINTS OF CONTACT. The USACHPPM points of contact for this assessment are
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Environmental Scientist
Deployment Environmental Surveillance
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Approved by:

(b) (6)

MAJ, MS
Program Manager
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APPENDIX A
 SAMPLING SUMMARY

Table A–1. Summary for PM_{2.5} and PM₁₀ Ambient Air Samples Collected at Sykes, Iraq, 10–14 August 2008

Sample ID	Field/Local Sample ID	Location	Start Date/Time	Exposure Notes	Sample Time	PM Mini-Vol Sampler Serial #
00000D97	IRQ_SYKES_PM25_08223	SYKES	2008/08/10 0940	Burn pit not in operation.	1440.0 min	3930
00000D98	IRQ_SYKES_PM25_08225	SYKES	2008/08/12 0950	Burn pit not in operation. Wind 1miles per hour from North East.	1422.0 min	3930
00000D99	IRQ_SYKES_PM10_08226	SYKES	2008/08/13 0955	Burn pit not in operation. Wind blowing away from Forward Operating Base (FOB).	1422.0 min	2839
00000D9A	IRQ_SYKES_PM25_08227	SYKES	2008/08/14 0945	Burn pit not in operation. No wind.	1428.0 min	3930
00000D9C	IRQ_SYKES_PM25_08226	SYKES	2008/08/13 0955	Burn pit not in operation. Wind blowing away from FOB.	1398.0 min	3990

Deployment OEH Risk Characterization, Ambient Air PM Samples, Sykes, Iraq, 10–14 Aug 08,
 U_IRQ_SYKES_CM_A10-25_20080814

Table A–1. Summary for PM_{2.5} and PM₁₀ Ambient Air Samples Collected at Sykes, Iraq, 10–14 August 2008 (continued)

Sample ID	Field/Local Sample ID	Location	Start Date/Time	Exposure Notes	Sample Time	PM Mini-Vol Sampler Serial #
00000D9D	IRQ_SYKES_PM10_08223	SYKES	2008/08/10 0940	Burn pit not in operation. Wind blowing back towards FOB.	1440.0 min	2839
00000D9E	IRQ_SYKES_PM10_08224	SYKES	2008/08/11 1010	Burn pit not in operation. Wind blowing away from FOB South East at 2 mph.	1398.0 min	2839
00000D9F	IRQ_SYKES_PM10_08225	SYKES	2008/08/12 0950	Burn pit not in operation.	1440.0 min	2839
00000D9G	IRQ_SYKES_PM10_08227	SYKES	2008/08/14 0945	Burn pit not in operation. No wind.	1428.0 min	2839

Note:
 DPS - deployable particulate sampler

APPENDIX B

SAMPLE RESULTS SUMMARY

Table B–1. Results Summary for PM₁₀ Ambient Air Samples Collected at Sykes, Iraq, 10–14 August 2008

Analyte	Units	Result		Samples #	CHPPM TG230 Military Exposure Guidelines	
		Max	Avg		1yr	
					# > MEG	MEG
Antimony	ug/m3	0.069964	0.066526	5	0	12
Arsenic	ug/m3	0.034982	0.033263	5	0	1.1
Beryllium	ug/m3	0.034982	0.033263	5	0	0.014
Cadmium	ug/m3	0.034982	0.033263	5	0	0.24
Chromium	ug/m3	0.034982	0.033263	5	0	12
Lead	ug/m3	0.069964	0.066526	5	0	12
Manganese	ug/m3	0.13993	0.13305	5	0	3.4
Nickel	ug/m3	0.034982	0.033263	5	0	37
Vanadium	ug/m3	0.13993	0.13305	5	0	0.14
Zinc	ug/m3	0.34982	0.33263	5	0	2400
PARTICULATE <10M (PM-10)	ug/m3	422	388	5	1	50

Note:
 Highlighted values indicate the parameter was detected at a concentration above a MEG

Deployment OEH Risk Characterization, Ambient Air PM Samples, Sykes, Iraq, 10–14 Aug 08,
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Table B–2. Results Summary for PM_{2.5} Ambient Air Samples Collected at Sykes, Iraq, 10–14 August 2008

Analyte	Units	Result		Samples #	CHPPM TG230 1yr	
		Max	Avg		# >	Value
		Antimony	ug/m3		0.071267	0.067641
Arsenic	ug/m3	0.035634	0.033821	4	0	1.1
Beryllium	ug/m3	0.035634	0.033821	4	0	0.014
Cadmium	ug/m3	0.035634	0.033821	4	0	0.24
Chromium	ug/m3	0.035634	0.033821	4	0	12
Lead	ug/m3	0.071267	0.067641	4	0	12
Manganese	ug/m3	0.14253	0.13528	4	0	3.4
Nickel	ug/m3	0.035634	0.033821	4	0	37
Vanadium	ug/m3	0.14253	0.13528	4	0	0.14
Zinc	ug/m3	0.35634	0.33821	4	0	2400
PARTICULATE <2.5M (PM-2.5)	ug/m3	126	108	4	1	35

APPENDIX C

DETAILED SAMPLE RESULTS

Table C–1. Analytical Results for PM_{2.5} and PM₁₀ Ambient Air Samples Collected at Sykes, Iraq, 10–14 August 2008

Sample ID		00000D97	00000D98	00000D99	00000D9A	00000D9C
Field/Local Sample ID		IRQ_SYKES_PM25_08223	IRQ_SYKES_PM25_08225	IRQ_SYKES_PM10_08226	IRQ_SYKES_PM25_08227	IRQ_SYKES_PM25_08226
Country		Iraq	Iraq	Iraq	Iraq	Iraq
Location		SYKES	SYKES	SYKES	SYKES	SYKES
Start Date		2008/08/10 0940	2008/08/12 0950	2008/08/13 0955	2008/08/14 0945	2008/08/13 0955
Analyte	Units	Results				
Antimony	µg/m ³	< 0.12909	< 0.14253	< 0.12775	< 0.14205	< 0.12746
Arsenic	µg/m ³	< 0.064545	< 0.071267	< 0.063876	< 0.071025	< 0.063728
Beryllium	µg/m ³	< 0.064545	< 0.071267	< 0.063876	< 0.071025	< 0.063728
Cadmium	µg/m ³	< 0.064545	< 0.071267	< 0.063876	< 0.071025	< 0.063728
Chromium	µg/m ³	< 0.064545	< 0.071267	< 0.063876	< 0.071025	< 0.063728
Lead	µg/m ³	< 0.12909	< 0.14253	< 0.12775	< 0.14205	< 0.12746
Manganese	µg/m ³	< 0.25818	< 0.28507	< 0.25550	< 0.28410	< 0.25491
Nickel	µg/m ³	< 0.064545	< 0.071267	< 0.063876	< 0.071025	< 0.063728
PARTICULATE <10M	µg/m ³			412		
PARTICULATE <2.5M	µg/m ³	75	105		125	127
Vanadium	µg/m ³	< 0.25818	< 0.28507	< 0.25550	< 0.28410	< 0.25491
Zinc	µg/m ³	< 0.64545	< 0.71267	< 0.63876	< 0.71025	< 0.63728

Deployment OEH Risk Characterization, Ambient Air PM Samples, Sykes, Iraq, 10–14 Aug 08,
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Table C–1. Analytical Results for PM_{2.5} and PM₁₀ Ambient Air Samples Collected at Sykes, Iraq,
 10–14 August 2008 (continued)

Sample ID		00000D9D	00000D9E	00000D9F	00000D9G
Field/Local Sample ID		IRQ_SYKES_PM10_08223	IRQ_SYKES_PM10_08224	IRQ_SYKES_PM10_08225	IRQ_SYKES_PM10_08227
Country		Iraq	Iraq	Iraq	Iraq
Location		SYKES	SYKES	SYKES	SYKES
Start Date		2008/08/10 0940	2008/08/11 1010	2008/08/12 0950	2008/08/14 0945
Analyte	Units	Results			
Antimony	µg/m ³	< 0.13170	< 0.12652	< 0.13936	< 0.13993
Arsenic	µg/m ³	< 0.065849	< 0.063261	< 0.069680	< 0.069964
Beryllium	µg/m ³	< 0.065849	< 0.063261	< 0.069680	< 0.069964
Cadmium	µg/m ³	< 0.065849	< 0.063261	< 0.069680	< 0.069964
Chromium	µg/m ³	< 0.065849	< 0.063261	< 0.069680	< 0.069964
Lead	µg/m ³	< 0.13170	< 0.12652	< 0.13936	< 0.13993
Manganese	µg/m ³	< 0.26339	< 0.25304	< 0.27872	< 0.27985
Nickel	µg/m ³	< 0.065849	< 0.063261	< 0.069680	< 0.069964
PARTICULATE <10M	µg/m ³	234	252	373	422
PARTICULATE <2.5M	µg/m ³				
Vanadium	µg/m ³	< 0.26339	< 0.25304	< 0.27872	< 0.27985
Zinc	µg/m ³	< 0.65849	< 0.63261	< 0.69680	< 0.69964

Notes:

< X.XX - Below laboratory reporting limit (X.XX)

Laboratory reporting limit is parameter and sample specific