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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, Salerno, Afghanistan, 28 January 2009 –
5 February 2009, U_AFG_SALERNO_CM_A10_20090205

1. The enclosed assessment details the occupational and environmental health (OEH) risk characterization for nine valid ambient air samples collected by 801st Brigade Support Battalion personnel, Salerno, Afghanistan, 28 January–5 February 2009. One additional sample was submitted, but was invalid due to sample filter damage.
2. The OEH risk estimate for exposure to particulate matter less than 10 micrometers in diameter (PM₁₀) and metals in the ambient air at Salerno, Afghanistan for this sampling event is **low**. Exposure to the ambient air is expected to have little or no impact on unit readiness.

FOR THE COMMANDER:

Encl

(b) (6)

(b) (6)

Director, Health Risk Management

CF: (w/encl)

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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
SALERNO, AFGHANISTAN
28 JANUARY 2009 – 5 FEBRUARY 2009
U_AFG_SALERNO_CM_A10_20090205



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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 Salerno, Afghanistan.

3. SCOPE. This assessment addresses the analytical results for nine valid ambient air samples collected from Salerno, Afghanistan, 28 January 2009 – 5 February 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 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 Salerno, Afghanistan. More specifically, these samples were collected during periods of the day when air quality was perceived to be poor due to active local industry and military activities. A set of samples was collected from an area near the burn pit, incinerator, and cement factory, while another sample set was collected near the Combat Support Hospital (CSH)

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and living areas. See Table 1 for a complete list of the dates and locations for the samples assessed in this report. All personnel are expected to remain at this location for a deployment duration 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 (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 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 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 AND HAZARD ASSESSMENT.

a. Sample Information. Nine valid samples were collected with the DPS™ apparatus. Six samples were collected in the burn pit/incinerator/cement factory area and three samples were collected at the CSH/living area. One additional sample was invalidated because the sample media was damaged. Sample durations ranged from approximately 23 hours to 6 hours depending on whether the burn pit, incinerator, and/or cement factory were active. (DPS™ is a trademark of SKC, Inc.)

b. Laboratory Analysis. The samples were analyzed for PM less than or equal to 10 micrometers in diameter (PM₁₀) and metals. Detected metals identified above the laboratory reportable limit were compared to MEGs presented in TG 230, while PM₁₀ concentrations were compared to the AQI. 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.

c. Assessment.

(1) Particulate Matter. Since PM₁₀ was measured at concentrations above the AQI good range, PM₁₀ 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. Primary sources of 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 OEHRisk 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 observed average concentration of PM₁₀ for all samples (regardless of sample duration) was 264 micrograms per cubic meter (µg/m³). This concentration falls within the range of concentrations that are believed to pose health concerns based on a 24-hour exposure to susceptible groups, which in the military can include asthmatics or persons with pre-

existing cardiopulmonary disease. However, as stated previously, these samples were collected during short periods of time chosen to represent elevated hazard concentrations during burn pit/incinerator operation and active local industry. It is expected that this observed average concentration actually overestimates a 24-hour exposure concentration which would include periods of lower hazard concentrations due to inactivity at the burn pits and/or local industry. Based upon this observed average concentration, exposure to PM₁₀ during these times of poor air quality may cause generally healthy troops to have some eye, nasal, or throat irritation, but little or no impact on unit readiness is expected. Therefore, the hazard severity is considered **negligible**.

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. 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 probability that the severity of a hazard is negligible is based on a comparison of the individual sample concentrations to the PM₁₀ 24-hour NAAQS of 150 µg/m³. During this sampling event, all of the sample durations were less than 24 hours, therefore, it is expected that the observed concentrations actually overestimate a 24-hour exposure concentration which would include periods of lower hazard concentrations due to inactivity at the burn pits/incinerator and/or local industry. On some of the days sampled, there was a sizeable range of PM₁₀ concentrations. There was also a sizeable range of PM₁₀ concentrations across the entire sampling event (55–1,135 µg/m³) – see Table 1 below. Daily average concentrations were calculated (regardless of sample site) for use in the hazard probability determination. Three of 6 (or 50 percent) of the daily average PM₁₀ concentrations are 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 above 150 µg/m³ is considered **occasional**.

Table 1. PM₁₀ Concentration by Date and Site at Salerno, Afghanistan

Sample Date	Sample Site			
	Burn Pit/Incinerator/Cement Factory		CSH/Living Area	
	PM ₁₀ Concentration (µg/m ³)	Sample Duration (hours)	PM ₁₀ Concentration (µg/m ³)	Sample Duration (hours)
28 Jan 09	125	23.3	None	
29 Jan 09	232	8	None	
30 Jan 09	101	8	None	
31 Jan 09	Invalid		None	
02 Feb 09	73	23.3	1135	11.2
04 Feb 09	257	6.4	241	7.6
05 Feb 09	55	8	157	8.5

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 2 summarizes the risk estimate for each identified hazard. The risk estimate for exposure to PM₁₀ and metals in the ambient air at Salerno, Afghanistan during this sampling event is considered **low**. Using TG 230, Table 3–5 as a guide, confidence in the risk estimate is considered **low** due to the variability in sample duration compared to a 24-hour guideline, and the variability in concentrations from samples collected on the same day. 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 2. Risk Estimate Summary for Exposure to PM₁₀ and Metals in the Ambient Air, Salerno, Afghanistan, 28 January – 5 February 2009

Parameter	Hazard Severity	Hazard Probability	Hazard-Specific Risk Estimate	Operational Risk Estimate	Confidence
PM ₁₀	NEGLIGIBLE	OCCASIONAL	LOW	LOW	LOW
Metals	No parameters detected above a MEG		LOW		

8. **CONCLUSION.** The OEH risk estimate for exposure to PM₁₀ and metals in the ambient air at Salerno, Afghanistan, 29 January–5 February 2009 is **low**. The air samples assessed in this report were collected over short time periods (less than 24 hours) of perceived poor air quality (expected elevated levels of PM₁₀ and metals). However, measured levels of PM₁₀ and metals during this sampling event were similar to typical 24-hour PM₁₀ and metals concentrations previously measured in the region. The measured levels during this sampling event are believed to represent the highest levels of a typical day at this location, so the sample concentrations assessed in this report overestimate an actual 24-hour exposure concentration for this location. Exposure to PM₁₀ and metals in the ambient air is expected to have little or no impact on unit readiness. Note that organic compounds are often emitted to the ambient air from military activities (such as, burn pits and incinerators) and local industrial activities (such as cement factories), and may be more of a health concern than PM₁₀ and metals.

9. RECOMMENDATIONS AND NOTE.

a. Recommendations.

(1) Collect 24-hour samples from this location at least once every 6 days for the deployment duration (or as long as possible) to better characterize the PM₁₀ and metals ambient air concentrations to which personnel are typically exposed.

(2) If there is continued concern about the air quality at this location due to the burn pit/incinerator and local industrial activities, consult with a USACHPPM DESP point of contact identified below regarding sampling for organic compounds in the ambient air.

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

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 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.

Deployment OEH Risk Characterization, Ambient Air PM Samples, Salerno, Afghanistan,
28 Jan–5 Feb 09, U_AFG_SALERNO_CM_A10_20090205

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 (312) 584-6096 or commercial 001 (410) 436-6096.

(b) (6)

Environmental Scientist
Deployment Environmental Surveillance
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Approved by:

(b) (6)

MAJ, MS
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Deployment OEH Risk Characterization, Ambient Air PM Samples, Salerno, Afghanistan, 28 Jan–5 Feb 09,
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APPENDIX A

SAMPLING SUMMARY
 AMBIENT AIR PARTICULATE MATTER SAMPLES
 SALERNO, AFGHANISTAN,
 28 JANUARY 2009–5 FEBRUARY 2009

Sample ID	Field/Local Sample ID	Location	Start Date/Time	Exposure Notes	Sample Time	Invalid Sample	Filter ID
00000M8N	AFG_SALERNO_PM10DPS_09028	SALERNO	2009/01/28 0945	Next to burn pit, incinerator, and cement factory	1399.0 min	No	47-07-1724
00000M8O	AFG_SALERNO_PM10DPS_09029	SALERNO	2009/01/29 0900	Next to burn pit, incinerator, and cement factory	480.0 min	No	47-07-1746
00000M8R	AFG_SALERNO_PM10DPS_09030	SALERNO	2009/01/30 0900	Next to burn pit, incinerator, and cement factory	480.0 min	No	47-07-0005
00000M8U	AFG_SALERNO_PM10DPS_09033	SALERNO	2009/02/02 1130	Next to burn pit, incinerator, and cement factory	1395.0 min	No	47-07-1699
00000M8Z	AFG_SALERNO_PM10DPS_09033	SALERNO	2009/02/02 1130	Next to CSH and Living Area	669.0 min	No	47-07-1700
00000N55	AFG_SALERNO_PM10DPS_09035	SALERNO	2009/02/04 0922	Next to CSH and Living Area	453.0 min	No	47-07-0013
00000N56	AFG_SALERNO_PM10DPS_09035-1	SALERNO	2009/02/04 1017	Sample next to burn pit, incinerator, and cement factory	383.0 min	No	47-07-1697
00000N58	AFG_SALERNO_PM10DPS_09036	SALERNO	2009/02/05 0850	Next to CSH and living areas	510.0 min	No	47-07-0009
00000N59	AFG_SALERNO_PM10DPS_09036-1	SALERNO	2009/02/05 0910	Next to burn pit, incinerator and cement factory	480.0 min	No	47-07-1714
	AFG_SALERNO_PM10DPS_09031	SALERNO	2009/01/31 0905	Next to burn pit, incinerator, and cement factory		Yes	47-07-1665

Deployment OEH Risk Characterization, Ambient Air PM Samples, Salerno, Afghanistan, 28 Jan–5 Feb 09,
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APPENDIX B

SAMPLE RESULTS SUMMARY
 AMBIENT AIR PARTICULATE MATTER SAMPLES
 SALERNO, AFGHANISTAN,
 28 JANUARY 2009–5 FEBRUARY 2009

Parameter	Units	Result		Samples (Valid)		USACHPPM TG230 Military Exposure Guidelines	
		Maximum	Average	#	# > Laboratory Reporting Limit	1year	
						# > MEG	MEG
PM 10	µg/m ³	1135	264	9	9	9	50

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

Deployment OEH Risk Characterization, Ambient Air PM Samples, Salerno, Afghanistan, 28 Jan–5 Feb 09,
 U_AFG_SALERNO_CM_A10_20090205

APPENDIX C

DETAILED SAMPLE RESULTS
 AMBIENT AIR PARTICULATE MATTER SAMPLES
 SALERNO, AFGHANISTAN,
 28 JANUARY 2009–5 FEBRUARY 2009

Sample ID				00000M8N	00000M8O	00000M8R	00000M8U	00000M8Z
Field/Local Sample ID				AFG_SALERNO _PM10DPS_09028	AFG_SALERNO _PM10DPS_09029	AFG_SALERNO _PM10DPS_09030	AFG_SALERNO _PM10DPS_09033	AFG_SALERNO _PM10DPS_09033
Country				Afghanistan	Afghanistan	Afghanistan	Afghanistan	Afghanistan
Location				SALERNO	SALERNO	SALERNO	SALERNO	SALERNO
Start Date				2009/01/28 0945	2009/01/29 0900	2009/01/30 0900	2009/02/02 1130	2009/02/02 1130
Analyte	CAS	Class	Units	Results				
Antimony	7440-36-0	Metals	µg/m ³	< 0.069736	< 0.20627	< 0.20627	< 0.070975	< 0.14948
Arsenic	7440-38-2	Metals	µg/m ³	< 0.034868	< 0.10314	< 0.10314	< 0.035487	< 0.074738
Beryllium	7440-41-7	Metals	µg/m ³	< 0.034868	< 0.10314	< 0.10314	< 0.035487	< 0.074738
Cadmium	7440-43-9	Metals	µg/m ³	< 0.034868	< 0.10314	< 0.10314	< 0.035487	< 0.074738
Chromium	7440-47-3	Metals	µg/m ³	< 0.034868	< 0.10314	< 0.10314	< 0.035487	< 0.074738
Lead	7439-92-1	Metals	µg/m ³	< 0.069736	< 0.20627	< 0.20627	< 0.070975	< 0.14948
Manganese	7439-96-5	Metals	µg/m ³	< 0.13947	< 0.41254	< 0.41254	< 0.14195	< 0.29895
Nickel	7440-02-0	Metals	µg/m ³	< 0.034868	< 0.10314	< 0.10314	< 0.035487	< 0.074738
PM 10			µg/m ³	125	232	101	73	1135
Vanadium	7440-62-2	Metals	µg/m ³	< 0.13947	< 0.41254	< 0.41254	< 0.14195	< 0.29895
Zinc	7440-66-6	Metals	µg/m ³	< 0.34868	< 1.0314	< 1.0314	< 0.35487	< 0.74738

Deployment OEH Risk Characterization, Ambient Air PM Samples, Salerno, Afghanistan, 28 Jan–5 Feb 09,
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Sample ID				00000N55	00000N56	00000N58	00000N59
Field/Local Sample ID				AFG_SALERNO _PM10DPS_09035	AFG_SALERNO _PM10DPS_09035-1	AFG_SALERNO _PM10DPS_09036	AFG_SALERNO _PM10DPS_09036-1
Country				Afghanistan	Afghanistan	Afghanistan	Afghanistan
Location				SALERNO	SALERNO	SALERNO	SALERNO
Start Date				2009/02/04 0922	2009/02/04 1017	2009/02/05 0850	2009/02/05 0910
Analyte	CAS	Class	Units	Results			
Antimony	7440-36-0	Metals	µg/m ³	< 0.21856	0.8169	< 0.19414	< 0.20627
Arsenic	7440-38-2	Metals	µg/m ³	< 0.10928	< 0.12926	< 0.097069	< 0.10314
Beryllium	7440-41-7	Metals	µg/m ³	< 0.10928	< 0.12926	< 0.097069	< 0.10314
Cadmium	7440-43-9	Metals	µg/m ³	< 0.10928	< 0.12926	< 0.097069	< 0.10314
Chromium	7440-47-3	Metals	µg/m ³	< 0.10928	< 0.12926	< 0.097069	< 0.10314
Lead	7439-92-1	Metals	µg/m ³	< 0.21856	< 0.25851	< 0.19414	< 0.20627
Manganese	7439-96-5	Metals	µg/m ³	< 0.43713	< 0.51702	< 0.38827	< 0.41254
Nickel	7440-02-0	Metals	µg/m ³	< 0.10928	< 0.12926	< 0.097069	< 0.10314
PM 10			µg/m ³	241	257	157	55
Vanadium	7440-62-2	Metals	µg/m ³	< 0.43713	< 0.51702	< 0.38827	< 0.41254
Zinc	7440-66-6	Metals	µg/m ³	< 1.0928	< 1.2926	< 0.97069	< 1.0314

Note:

<X.XXX - Below laboratory reporting limit