DEPARTMENT OF THE ARMY
US ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
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NOV 20 2008

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, Adder, Iraq, 31 July–29 August 2008, U_IRQ_ADDER_CM_A10_20080829

1. The enclosed assessment details the risk characterization for 8 valid ambient particulate matter air samples collected by 71st Medical Detachment – Preventive Medicine personnel at Adder, Iraq, 31 July–29 August 2008. Two additional samples submitted for analysis were invalid. One sample blank was also collected.

2. The occupational and environmental health risk (OEH) estimate for exposure to the ambient air particulate matter at Adder, Iraq, based on sample results for PM_{10}, is **moderate**. Exposure to the ambient air on days with similar conditions may degrade unit readiness if the conditions occur during the mission.

FOR THE COMMANDER:

(b) (6)

Director, Health Risk Management

Encl

CF: (w/encl)
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MNC-I (Command Surgeon/LTC (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
ADDER, IRAQ
31 JULY–29 AUGUST 2008
U_IRQ_ADDER_CM_A10_20080829

USCHPPM

Readiness Thru Health

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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 Adder, Iraq.

3. SCOPE. This assessment addresses the analytical results for eight valid ambient air particulate matter samples collected from Adder, Iraq, 31 July–29 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 obtained to assess the potential for adverse health effects to troops routinely and continuously breathing the ambient air at Adder, Iraq. Four valid samples were collected near Building 208 and four valid samples were collected near the vector control area. Sand storms were reported throughout the

sampling event. The field data sheets indicated that there is a burn pit located 200 meters southeast of the vector control point and a cement plant and bulk waste incinerator located between 700 and 750 meters away from the vector control point. An open burn pit is located to the east of building 208; it was actively burning paper during the sampling period. Personnel are expected to remain at this location for approximately 1 year. A conservative (protective) assumption is that 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 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. Eight valid samples were collected with the Mini-Vol™ apparatus. These samples were analyzed for PM concentrations and metals. A field blank was also submitted with the samples. Two additional samples were invalid due to sampler malfunction. (Mini-Vol™ is a registered trademark of Airmetrics, Inc.)

b. Laboratory Analysis. The eight valid samples and one blank 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 compared to the AQI and assessed using the process described in paragraph 5. Appendix A shows a summary of the samples assessed in this report. Appendix B shows a separate sample results summary table for the samples collected at the burn pit and the TMC. Appendix C shows complete analytical results for the individual samples.

c. Assessment.

(1) The PM_{10}. Since 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 this 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 is based on an approximation of the percentage of personnel anticipated to exhibit health effects when exposed to hazard concentrations at or above

an exposure guideline. In addition, the hazard severity depends on the nature of the health effects and the magnitude of the estimated exposure concentration relative to the comparison guideline. The hazard severity for metals is determined by comparing the estimated exposure concentration to MEGs published in TG 230 and by using TG 230, Table 3–1, as a guide. The hazard severity for PM_{10} used in determining 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.

(2) The PM_{10}. The average concentration of PM_{10} at was 373 micrograms per cubic meter ($\mu g/m^3$). This concentration falls within the range of concentrations that the USEPA considers "hazardous," and are likely to affect the health of all personnel. In generally healthy troops, increased medical visits and respiratory infections may cause some operational impact (such as, 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.

(1) General. The hazard probability is based on an approximation of the percentage of personnel that would be exposed to an identified hazard above a guideline (in terms of concentration, exposure duration and frequency, and intake rate). The hazard probability for metals is determined by comparing the estimated exposure concentration to MEGs published in TG 230 and by using TG 230, Table 3–2, as a guide. For PM_{10}, the hazard probability reflects the likelihood that the exposures at a specific location are represented by the samples used to determine the hazard severity.

(2) The PM_{10}. Although the average PM_{10} sample concentration was within the marginal severity range, 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 $\mu g/m^3$).

(a) The Vector Control Area. At this sampling location the PM_{10} concentration range was 293–516 $\mu g/m^3$, and three of four (75 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 **likely**.

(b) Building 208. At this sampling location the PM_{10} concentration range was 229–436 µg/m^3, and one of four (25 percent) samples were above 350 µg/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 µg/m^3 is considered **seldom**.

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 exposure to PM_{10} in the ambient air at Adder is **moderate**. The risk estimate for exposure to the ambient air at this location is based on the highest identified hazard risk estimate. Table 1 summarizes the risk estimate for each identified hazard. According to TG 230, Table 3–5, confidence in the risk estimate at this location 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 1. Risk Estimate Summary Based on Ambient Air PM Samples Collected, Adder, Iraq

Parameter	Hazard Severity	Hazard Probability	Hazard-Specific Risk Estimate	Operational Risk Estimate	Confidence
PM_{10} (Vector Control)	MARGINAL	LIKELY	MODERATE	MODERATE	MEDIUM
PM_{10} (Building 208)	MARGINAL	SELDOM	LOW		
Other Metals	None detected above a MEG		LOW		

8. CONCLUSION. The OEH risk estimate for exposure to PM_{10} and metals the ambient air at the vector control point at Adder, Iraq, is **moderate** based on PM_{10}. Exposure to the ambient air on days with similar conditions may degrade unit readiness if the conditions occur during the mission.

9. RECOMMENDATIONS AND NOTE.

a. Recommendations.

(1) Consider collecting PM less than 2.5 microns in diameter ($PM_{2.5}$) samples as well as PM_{10} samples from this location at least once every 6 days for the deployment duration (or as

long as possible) to better characterize the $PM_{2.5}$ and/or PM_{10} and metals ambient air concentrations to which personnel are typically exposed

(2) 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–HQ Environmental Medicine Program at commercial 001 (410) 436-2714.

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(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, 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 Mr. (b) (6) and Ms. (b) (6). Mr. (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

SAMPLING SUMMARY

Table A–1. Summary for Ambient Air Samples Collected, Adder, Iraq, 31 July–29 August 2008

Sample ID	Field/Local Sample ID	Location	Start Date/Time	Exposure Notes	Sample Time
00000D0J	IRQ-ADDER-08213-PM10MV	ADDER	2008/07/31 1000	Start of Sampling Period: Prevailing winds out of the northwest. Cement batch plant 750 meters west; bulk waste incinerator 700 meters west; open burn pit 200 meters southeast. End of Sampling Period: Sampler ran 2 extra hours, did not stop as programmed. Sand storms.	1554.0 minutes
00000D0K	IRQ-ADDER-08212-PM10MV	ADDER	2008/07/31 1000	Start of Sampling Period: Prevailing winds out of the northwest; frequent sand storms. Cement batch plant 2 kilometers (km) east, bulk waste incinerator 2 km east, open burn pit 2.5 km east. End of Sampling Period: Burn barrier near Building 208 was burning paper during sampler operation. Sand storms- sampler ran 3 extra hours.	1620.0 minutes
00000D0M	IRQ-ADDER-08219-PM10MV	ADDER	2008/08/06 1415	Start of Sampling Period: Prevailing winds out of the northwest. Cement batch plant 750 meters west, bulk waste incinerator 700 meters west, open burn pit 200 meters southeast. End of Sampling Period: Sand storms	1440.0 minutes
00000D0N	IRQ-ADDER-08224-PM10MV	ADDER	2008/08/11 1100	Start of Sampling Period: Prevailing wind out of the northwest; frequent sand storms. Cement batch plant 2 km east, bulk waste incinerator 2 km east, open burn pit 2.5 km east. End of Sampling Period: Sand storms	1446.0 minutes

Table A–1. Summary for Ambient Air Samples Collected, Adder, Iraq, 31 July–29 August 2008 (continued)

Sample ID	Field/Local Sample ID	Location	Start Date/Time	Exposure Notes	Sample Time
00000D0O	IRQ-ADDER-08225-PM10MV	ADDER	2008/08/12 1400	Start of Sampling Period: Prevailing winds out of the northwest. Cement batch plant 750 meters west, bulk waste incinerator 700 meters west, open burn pit 200 meters southeast. End of Sampling Period: Sand storms.	1440.0 minutes
00000D0P	IRQ-ADDER-08230-PM10MV	ADDER	2008/08/17 1000	Start of Sampling Period: Prevailing wind out of the north west; frequent sand storms. Cement batch plant 2 km east, bulk waste incinerator 2 km east, open burn pit 2.5 km east. End of Sampling Period: Sand storms.	1440.0 minutes
00000D0Q	IRQ-ADDER-08231-PM10MV	ADDER	2008/08/18 1330	Start of Sampling Period: Prevailing winds out of the northwest. Cement batch plant 750 meters west, bulk waste incinerator 700 meters west, open burn pit 200 meters southeast. End of Sampling Period: Sand storms 15 miles per hour, blowing sands.	1440.0 minutes
00000D0R	IRQ-ADDER-08242-PM10MV	ADDER	2008/08/29 1220	Exposure Notes: Dust storm, strong winds. Start of Sampling Period: Prevailing wind out of the northwest; frequent sand storms. Cement batch plant 2 km east, bulk waste incinerator 2 km east, open burn pit 2.5 km east.	1440.0 minutes

APPENDIX B

SAMPLE RESULTS SUMMARY

Table B–1. Results Summary for Ambient Air Particulate Matter Samples Collected at Adder, Iraq, 31 July–29 August 2008

Analyte	Units	Result		Samples (Valid)		USACHPPM TG230 Military Exposure Guidelines 1 year	
		Maximum	Average	#	# > RL	# >	Value
Chromium	µg/m^3	0.06992	0.039229	8	1	0	12
Nickel	µg/m^3	0.078311	0.040278	8	1	0	37
PM10	µg/m^3	516	373	8	8	8	50

Notes:
Highlighted parameters indicated constituents greater than the MEG
RL - Laboratory Reporting Limit

APPENDIX C

DETAILED SAMPLE RESULTS

Table C–1. Analytical Results for Ambient Air Particulate Matter Samples Collected, Adder, Iraq, 31 July–29 August 2008

Sample ID		00000D0J	00000D0K	00000D0M	00000D0N	00000D0O	00000D0P	00000D0Q	00000D0R
Field/Local Sample ID		IRQ-ADDER-08213-PM10MV	IRQ-ADDER-08212-PM10MV	IRQ-ADDER-08219-PM10MV	IRQ-ADDER-08224-PM10MV	IRQ-ADDER-08225-PM10MV	IRQ-ADDER-08230-PM10MV	IRQ-ADDER-08231-PM10MV	IRQ-ADDER-08242-PM10MV
Country		Iraq	Iraq	Iraq	Iraq	Iraq	Iraq	Iraq	Iraq
Location		ADDER	ADDER	ADDER	ADDER	ADDER	ADDER	ADDER	ADDER
Start Date		2008/07/31 1000	2008/07/31 1000	2008/08/06 1415	2008/08/11 1100	2008/08/12 1400	2008/08/17 1000	2008/08/18 1330	2008/08/29 1220
Analyte	Units	Results							
Antimony	µg/m^3	< 0.13253	< 0.12903	< 0.14226	< 0.13927	< 0.13984	< 0.14082	< 0.15312	< 0.13860
Arsenic	µg/m^3	< 0.066265	< 0.064516	< 0.071132	< 0.069637	< 0.069920	< 0.070412	< 0.076559	< 0.069299
Beryllium	µg/m^3	< 0.066265	< 0.064516	< 0.071132	< 0.069637	< 0.069920	< 0.070412	< 0.076559	< 0.069299
Cadmium	µg/m^3	< 0.066265	< 0.064516	< 0.071132	< 0.069637	< 0.069920	< 0.070412	< 0.076559	< 0.069299
Chromium	µg/m^3	< 0.066265	< 0.064516	< 0.071132	< 0.069637	0.06992	< 0.070412	< 0.076559	< 0.069299
Lead	µg/m^3	< 0.13253	< 0.12903	< 0.14226	< 0.13927	< 0.13984	< 0.14082	< 0.15312	< 0.13860
Manganese	µg/m^3	< 0.26506	< 0.25806	< 0.28453	< 0.27855	< 0.27968	< 0.28165	< 0.30623	< 0.27720
Nickel	µg/m^3	< 0.066265	< 0.064516	< 0.071132	< 0.069637	0.078311	< 0.070412	< 0.076559	< 0.069299
PM10	µg/m^3	516	436	293	229	502	286	429	289
Vanadium	µg/m^3	< 0.26506	< 0.25806	< 0.28453	< 0.27855	< 0.27968	< 0.28165	< 0.30623	< 0.27720
Zinc	µg/m^3	< 0.66265	< 0.64516	< 0.71132	< 0.69637	< 0.69920	< 0.70412	< 0.76559	< 0.69299

Notes:
<X.XXX - less than laboratory reporting limit
Laboratory reporting limit is sample and parameter specific