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

23 JAN 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 Volatile Organic Compound Samples, Camp Taji, Iraq, 28 November 2007, U_IRQ_TAJI_CM_A17_20071128

1. The enclosed report details the occupational and environmental health (OEH) risk characterization for two volatile organic compound (VOC) ambient air samples collected by 1st Brigade Combat Team, 1st Cavalry Division personnel from Camp Taji, Iraq, 28 November 2007.

2. The OEH risk estimate for exposure to VOCs in the ambient air near areas surrounding the burn pit of Camp Taji, Iraq is **low**. The chemical 1, 2-Dibromo-3-chloropropane was detected at a concentration exceeding its military exposure guideline. However, exposure to VOCs in the ambient air for those working near the burn pit is expected to have little or no impact on unit readiness.

FOR THE COMMANDER:

(b) (6)

Director, Health Risk Management

Encl

CF: (w/encl)
1st BCT, 1st CD (Environmental Science Officer/2LT (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 VOLATILE ORGANIC COMPOUND SAMPLES
CAMP TAJI, IRAQ
28 NOVEMBER 2007
U_IRQ_TAJI_CM_A17_20071128

USCHPPM

Readiness Thru Health

DEPLOYMENT OCCUPATIONAL AND ENVIRONMENTAL
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1. REFERENCES.

a. 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.

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

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 above mentioned location.

3. SCOPE. This assessment addresses the analytical results of two volatile organic compounds (VOCs) air samples collected from Camp Taji, Iraq, 28 November 2007. 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 Camp Taji, Iraq. The samples were collected from an area that was approximately 300 meters directly down wind of the burn pit. The smoke plume was indicated to be blowing directly overhead. It is expected that less than 10 percent of the personnel will be exposed to the ambient air at this portion of Camp, Taji for a deployment duration of approximately 1 year. No adverse weather conditions were reported. In addition, it is assumed that control measures and/or personal protective equipment are not used.

5. METHOD. 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, based on currently available data. Information about potential health effects are obtained from data provided with the exposure values used to derive the MEGs and symptoms reported from occupational exposures. The quality and quantity of dose and response information available varies with the hazard and the determination of precise "no-effect" levels for low-level exposures for extended and duration involves professional judgment. Hazards with exposure concentrations greater than comparison levels 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.

6. HAZARD IDENTIFICATION.

a. Sample Information. Two valid samples were submitted for analysis. One sample was an associated field blank.

b. Laboratory Analysis. The two valid samples and one blank were analyzed by the USACHPPM–Headquarters laboratory for VOCs. Concentrations of VOCs detected above the laboratory reporting limit were compared to MEGs presented in TG 230. Appendix A provides a summary of the samples assessed in this report. Appendix B contains a summary of the sample results. Appendix C presents detailed laboratory results. The following parameter was detected at a concentration exceeding its 1 year air MEG. Therefore, the following parameter was identified as potential health threat requiring further assessment:

(1) 1,2-Dibromo-3-chloropropane (DBCP). The DBCP was detected in the one of the samples at a 0.95 micrograms per cubic meter (µg/m^3), which is above is MEG of 0.14 µg/m^3. The DBCP is a manufactured chemical and is not found naturally in the environment. It is a colorless liquid with a sharp acrid smell. Prior to the 1980, large amounts of DBCP were used on farms in the U.S. to kill pests that harmed crops. It has been banned for use as a pesticide in the U.S. but may be used as a pesticide in other countries. It is still used for other industrial purposes worldwide; for example, some industries use it to make chemical products that are used to make materials that resist burning. While it is commonly found as a water contaminant, it can volatilize at low levels from soil or water. Alternatively, it can become airborne during activities such as waste burning.

(2) Other Parameters. None of the other VOCs detected in the valid samples were present at concentrations greater than their respective MEGs. Therefore, no potential health threats were identified and the risk estimate for exposure to those VOCs in the ambient air is considered **low**.

7. HAZARD ASSESSMENT.

a. Hazard Severity.

(1) General. Hazard severity is a function of the consequence of exposure (for example, nature of probable effect) for any given Soldier in the unit, and the predicted distribution of that impact within the field unit. The estimation of the hazard severity involves the proportion of the field unit that is likely to exhibit effects relative to the specific exposure guidelines, nature of the health effect(s) associated with exposures at or above the guideline level, and confidence in the available data, given the sources of uncertainty and variability. Specifically the hazard severity for the identified potential health threat was determined by comparing the detected concentration to MEGs published in TG 230, by assessing the hazard's specific health effects information, and using TG 230, Table 3–1.

(2) DBCP.

(a) The 1,2-dibromo-3-chloropropane has a distinctive smell and short term exposures can cause eye, nose and throat irritation. Skin irritation may occur if levels are high enough. It has also been shown to cause headaches, nausea, lightheadedness, and weakness in workers. At significantly high levels in the air, it can cause acute damage of the respiratory tract, to include pulmonary edema. However, the most distinctive effect from breathing high levels of 1,2-dibromo-3-chloropropane, especially repeatedly/over long periods, is damage to the male reproductive system. Studies on workers chronically exposed to high levels of DBCP have shown that exposed men may produce fewer sperm, produce sperm that results in more girl than boy babies, or eventually become unable to father children. Animals breathing high levels of the chemical were not able to reproduce and had damaged stomachs, livers, kidneys, brains, spleens, blood, and lungs. Animals breathing low to moderate levels had damage to the reproductive system. The Department of Health and Human Services has also determined that DBCP may reasonably be anticipated to be a carcinogen.

(b) At this site, one sample taken about 300 yards and under the plume from a burn pit fire resulted in a concentration of 0.95 $\mu g/m^3$. This is within an order of magnitude and the confidence estimate of the long-term air MEG of 0.14 $\mu g/m^3$ for the year. This MEG is a protective value that is set based on continued exposure for one year. The exposure scenario points to a single, one-time exposure, as opposed to the long-term daily exposure scenario required to produce effects as estimated by the long-term MEG. It is noted that the detected

level is approximately equal to the current occupational exposure limit of 0.97 µg/m^3, which is the Occupational Safety and Health Administration permissible exposure limit for an 8-hour workday. When other sample data is combined, the average concentration is well below the long term MEG. Continued exposure is not anticipated, therefore the concentration of 1,2-dibromo-3-chloropropane detected at this site is considered to represent a **negligible** hazard severity.

b. Hazard Probability. The hazard probability was based on an approximation of the percent of personnel that would be exposed to an identified hazard above a MEG (in terms of concentration and exposure assumptions) and using TG 230, Table 3–2. The hazard probability represents the magnitude, frequency, and duration of personnel exposure to the identified hazard integrated with the expected incidence of exposure within the unit relative to associated guidelines. Although the deployment duration is greater than the 1-year exposure estimate used in developing the MEGs, it is unlikely that many personnel will be exposed to burn pit smoke plumes on a daily basis. The probability that personnel will be exposed to DBCP above the MEG an experience adverse health effects is considered **seldom**.

c. Operational 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 chemical-specific risk level of **low** for long-term exposure of the ambient area down wind of the burn pit. Table 1 illustrates the risk characterization summary for VOCs in that area. According to TG 230, Table 3–5, confidence in the risk estimate is considered **low** because it is based on only two samples directly downwind of the burn pit smoke plume. Exposure factors used to determine the risk estimate include the concentrations of the identified hazards, exposure duration, exposure frequency, and ingestion rate. Based on the information provided with the sample, it is expected that the assumptions of exposure duration is relatively accurate or may overestimate the total exposure. 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 Characterization Summary to VOCs Downwind of the Burn Pit at Camp Taji, Iraq

Parameter	Hazard Severity	Hazard Probability	Threat-Specific Risk Estimate	Operational Risk Estimate	Confidence
DBCP	NEGLIGIBLE	SELDOM	LOW	LOW	LOW
Other VOCs	Not detected at concentrations greater than MEGs		LOW		

8. CONCLUSION. The OEH risk estimate for exposure to VOCs in the ambient air near areas surrounding the burn pit of Camp Taji, Iraq is **low**. The chemical 1, 2-Dibromo-3-chloropropane was detected at a concentration exceeding its military exposure guideline. However, exposure to

VOCs in the ambient air for those working near the burn pit is expected to have little or no impact on unit readiness. Confidence is the risk estimate is considered **low** because it is based on only two samples directly downwind of the burn pit smoke plume.

9. RECOMMENDATIONS AND NOTE.

a. Recommendations.

(1) This compound's specific location has not been routinely identified in ambient air sampling. Follow-up monitoring under similar conditions should be conducted to ensure that this particular chemical is not repeatedly released. Any means to mitigate disposal/burning of materials that release this chemical should be instituted.

(2) 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 VOC concentrations in the ambient air to which personnel are typically exposed, and to increase confidence in risk estimates at this location.

(3) Attempt as best as possible to obtain valid VOC samples when the smoke plume is blowing more consistently in an area frequented by personnel.

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 location 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 Mr. (b) (6). Ms. (b) (6) may be contacted at e-mail (b) (6) and 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)

Acting Program Manager
Deployment Environmental Surveillance

APPENDIX A

SAMPLING SUMMARY

Table A–1. Summary for Ambient Air Samples Collected, Camp Taji, Iraq, 28 November 2007

Field Identification Number	DESP Identification Number	Sample Location	Collection Date	Tube Identification Number	Sample Duration	Invalid Sample (Yes/No)	Field Notes
IRQ_TAJI_BURNPIT03_20071128	IRQ_2726_TO17_07332_01	TAJI	28-Nov-07	C3886	342	No	PLUME DIRECTLY OVERHEAD. NOTICABLE ACRID CAMPFIRE SMELL. OUT OF BATTERIES WHEN FOUND
IRQ_TAJI_BURNPIT04_20071128	IRQ_2726_TO17_07332_02	TAJI	28-Nov-07	C3883	481	No	300M DIRECTLY DOWNWIND FROM THE BURN PIT

APPENDIX B

SAMPLE RESULTS SUMMARY

Table B–1. Results Summary for Ambient Air Samples Collected, Camp Taji, Iraq, 28 November 2007

						Military Exposure Guidelines					
		Detection Rate		Concentration ($\mu g/m^3$)					1-hour		
Parameter detected above laboratory limit	Units	# detected / # samples	# detected above MEG / # samples	Maximum	Average	1-year	14-days	8-hours	Minimal	Severe	Significant
Benzene	$\mu g/m^3$	2 / 2	0 / 2	6.91764	6.3221	39	160	1600	160000	3200000	480000
Cyclohexane	$\mu g/m^3$	2 / 2	0 / 2	0.93707	0.86903	4100	No MEG	No MEG	3000000	4000000	4000000
Decane	$\mu g/m^3$	2 / 2	0 / 2	2.18452	1.71698	No MEG	No MEG	No MEG	7500	25000000	50000
1,2-Dibromo-3-chloropropane	$\mu g/m^3$	1 / 2	1 / 2	0.94662	0.60346	0.14	No MEG	No MEG	No MEG	No MEG	No MEG
Ethylbenzene	$\mu g/m^3$	2 / 2	0 / 2	18.93248	16.4943	3000	11000	440000	540000	8700000	3500000
Hexachlorobutadiene	$\mu g/m^3$	2 / 2	0 / 2	2.1117	1.36821	5.2	5	240	32000	320000	107000
Hexane	$\mu g/m^3$	2 / 2	0 / 2	3.64086	3.22604	4300	4300	180000	530000	3900000	880000
Isooctane	$\mu g/m^3$	2 / 2	0 / 2	1.09226	0.88452	No MEG	No MEG	No MEG	350000	7500000	1800000
Isopropylbenzene	$\mu g/m^3$	2 / 2	0 / 2	2.33015	1.972	2700	No MEG	No MEG	250000	4000000	250000
Methylene chloride	$\mu g/m^3$	2 / 2	0 / 2	0.87381	0.6972	2100	2100	175000	700000	14000000	2600000
n-Propylbenzene	$\mu g/m^3$	2 / 2	0 / 2	3.42241	2.85652	25	No MEG	No MEG	No MEG	No MEG	No MEG
Styrene	$\mu g/m^3$	2 / 2	0 / 2	3.71368	3.21039	2000	No MEG	No MEG	210000	4300000	1100000

Table B–1. Results Summary for Ambient Air Samples Collected, Camp Taji, Iraq, 28 November 2007 (continued)

						Military Exposure Guidelines					
		Detection Rate		Concentration (µg/m^3)					1-hour		
Parameter detected above laboratory limit	Units	# detected / # samples	# detected above MEG / # samples	Maximum	Average	1-year	14-days	8-hours	Minimal	Severe	Significant
Toluene	µg/m^3	2 / 2	0 / 2	66.2637	58.12048	4600	11000	750000	750000	11000000	2000000
1,2,3-Trichlorobenzene	µg/m^3	1 / 2	0 / 2	2.76706	1.7089	No MEG	No MEG	No MEG	15000	500000	130000
1,2,4-Trichlorobenzene	µg/m^3	2 / 2	0 / 2	2.18452	1.40462	1400	No MEG	No MEG	No MEG	No MEG	No MEG
1,3,5-Trimethylbenzene	µg/m^3	2 / 2	0 / 2	4.29622	3.60578	3100	No MEG	No MEG	No MEG	No MEG	No MEG
1,2,4-Trimethylbenzene	µg/m^3	2 / 2	0 / 2	18.20431	15.34931	3100	No MEG	No MEG	No MEG	No MEG	No MEG
o-Xylene	µg/m^3	2 / 2	0 / 2	24.02969	20.86499	11000	11000	440000	650000	3900000	870000
Methylcyclopentane	µg/m^3	2 / 2	0 / 2	1.60198	1.39968	No MEG	No MEG	No MEG	No MEG	No MEG	No MEG
m,p-Xylene	µg/m^3	2 / 2	0 / 2	56.79745	49.48288	No MEG	No MEG	No MEG	No MEG	No MEG	No MEG

Notes:
µg/m^3 - microgram per cubic meter
No MEG - MEG not established

APPENDIX C

DETAILED SAMPLE RESULTS

Table C–1. Analytical Results for Ambient Air Samples Collected from Camp Taji, Iraq, 28 November 2007

		Field ID	IRQ_TAJI_BURNPIT03_20071128	IRQ_TAJI_BURNPIT04_20071128
		DESP ID	IRQ_2726_TO17_07332_01	IRQ_2726_TO17_07332_02
		Location	TAJI	TAJI
		Collection Date	28-Nov-07	28-Nov-07
		Collection Time	8:00	8:00
Parameter	Chemical Abstract Number	Units	Concentration	Concentration
1,1,1,2-Tetrachloroethane	630206	µg/m^3	< 0.728172	< 0.520596
1,1,1-Trichloroethane	71556	µg/m^3	< 0.728172	< 0.520596
1,1,2,2-Tetrachloroethane	79345	µg/m^3	< 0.728172	< 0.520596
1,1,2-Trichloroethane	79005	µg/m^3	< 0.728172	< 0.520596
1,1-Dichloroethane	75343	µg/m^3	< 0.728172	< 0.520596
1,1-Dichloroethene	75354	µg/m^3	< 0.728172	< 0.520596
1,1-Dichloropropene	563586	µg/m^3	< 0.728172	< 0.520596
1,2,3-Trichlorobenzene	87616	µg/m^3	**2.767055**	< 1.301491
1,2,3-Trichloropropane	96184	µg/m^3	< 0.728172	< 0.520596
1,2,4-Trichlorobenzene	120821	µg/m^3	**2.184517**	**0.624716**
1,2,4-Trimethylbenzene	95636	µg/m^3	**18.204312**	**12.494316**
1,2-Dibromo-3-chloropropane	96128	µg/m^3	**0.946624**	< 0.520596
1,2-Dibromoethane	106934	µg/m^3	< 0.728172	< 0.520596
1,2-Dichlorobenzene	95501	µg/m^3	< 0.728172	< 0.520596
1,2-Dichloroethane	107062	µg/m^3	< 0.728172	< 0.520596
1,2-Dichloropropane	78875	µg/m^3	< 0.728172	< 0.520596
1,3,5-Trimethylbenzene	108678	µg/m^3	**4.296218**	**2.91534**
1,3-Dichlorobenzene	541731	µg/m^3	< 0.728172	< 0.520596
1,3-Dichloropropane	142289	µg/m^3	< 0.728172	< 0.520596
1,4-Dichlorobenzene	106467	µg/m^3	< 0.728172	< 0.520596
2,2-Dichloropropane	594207	µg/m^3	< 0.728172	< 0.520596
2-Chlorotoluene	95498	µg/m^3	< 0.728172	< 0.520596
4-Chlorotoluene	106434	µg/m^3	< 0.728172	< 0.520596
4-Isopropyltoluene	99876	µg/m^3	< 0.728172	< 0.520596
Benzene	71432	µg/m^3	**6.917639**	**5.726561**
Bromobenzene	108861	µg/m^3	< 0.728172	< 0.520596

Deployment OEH Risk Characterization, Ambient Air VOC Samples, Camp Taji, Iraq, 28 Nov 07, U_IRQ_TAJI_CM_A17_20071128

Table C–1. Analytical Results for Ambient Air Samples Collected from Camp Taji, Iraq, 28 November 2007 (continued)

		Field ID	IRQ_TAJI_BURNPIT03_20071128	IRQ_TAJI_BURNPIT04_20071128
		DESP ID	IRQ_2726_TO17_07332_01	IRQ_2726_TO17_07332_02
		Location	TAJI	TAJI
		Collection Date	28-Nov-07	28-Nov-07
		Collection Time	8:00	8:00
Parameter	Chemical Abstract Number	Units	Concentration	Concentration
Bromochloromethane	74975	µg/m^3	< 0.728172	< 0.520596
Bromodichloromethane	75274	µg/m^3	< 0.728172	< 0.520596
Bromoform	75252	µg/m^3	< 0.728172	< 0.520596
Carbon tetrachloride	56235	µg/m^3	< 0.728172	< 0.520596
Chlorobenzene	108907	µg/m^3	< 0.728172	< 0.520596
Chloroform	67663	µg/m^3	< 0.728172	< 0.520596
Cyclohexane	110827	µg/m^3	**0.80099**	**0.937074**
Cyclopentane	287923	µg/m^3	< 0.728172	< 0.520596
Decane	124185	µg/m^3	**2.184517**	**1.249432**
Dibromochloromethane	124481	µg/m^3	< 0.728172	< 0.520596
Dibromomethane	74953	µg/m^3	< 0.728172	< 0.520596
Ethylbenzene	100414	µg/m^3	**18.932485**	**14.056105**
Hexachlorobutadiene	87683	µg/m^3	**2.1117**	**0.624716**
Hexane	110543	µg/m^3	**3.640862**	**2.811221**
Isooctane	540841	µg/m^3	**1.092259**	**0.676775**
Isopropylbenzene	98828	µg/m^3	**2.330152**	**1.613849**
Methylcyclopentane	96377	µg/m^3	**1.601979**	**1.197372**
Methylene chloride	75092	µg/m^3	**0.873807**	**0.520596**
Styrene	100425	µg/m^3	**3.71368**	**2.707102**
Tetrachloroethene {PCE}	127184	µg/m^3	< 0.728172	< 0.520596
Toluene	108883	µg/m^3	**66.263696**	**49.977263**
Trichloroethene {TCE}	79016	µg/m^3	< 0.728172	< 0.520596
cis-1,2-Dichloroethene	156592	µg/m^3	< 0.728172	< 0.520596
cis-1,3-Dichloropropene	10061015	µg/m^3	< 0.728172	< 0.520596
m,p-Xylene	E966689	µg/m^3	**56.797454**	**42.168316**
n-Butylbenzene	104518	µg/m^3	< 0.728172	< 0.520596
n-Propylbenzene	103651	µg/m^3	**3.422411**	**2.290625**
o-Xylene	95476	µg/m^3	**24.029692**	**17.700281**
sec-Butylbenzene	135988	µg/m^3	< 0.728172	< 0.520596
tert-Butylbenzene	98066	µg/m^3	< 0.728172	< 0.520596
trans-1,2-Dichloroethene	156605	µg/m^3	< 0.728172	< 0.520596
trans-1,3-Dichloropropene	10061026	µg/m^3	< 0.728172	< 0.520596

Note: Where parameters are not detected in a sample during analyses, half of the laboratory reportable limit is used in the average