

**Military Deployment**  
**Periodic Occupational and Environmental Monitoring Summary (POEMS):**  
**Camp Taji, Iraq, Calendar Years: 2009 to 2011**

**AUTHORITY:** This periodic occupational and environmental monitoring summary (POEMS) has been developed in accordance with Department of Defense (DoD) Instructions 6490.03, 6055.05, and JCSM (MCM) 0028-07, See *REFERENCES*.

**PURPOSE:** This POEMS documents the Department of Defense (DoD) assessment of Occupational and Environmental Health (OEH) risk for Camp Taji, Iraq. It presents a qualitative summary of health risks identified at this location and their potential medical implications. The findings were based on information collected from 1 September 2009 through the 2011 withdrawal of U.S. Forces to include deployment OEH sampling and monitoring data (e.g. air, water, and soil), field investigation and health assessment reports, as well as country and area-specific information on endemic diseases.

This assessment assumes that environmental sampling at Camp Taji during this period was performed at representative exposure points selected to characterize health risks at the *population-level*. Due to the nature of environmental sampling, the data upon which this report is based may not be fully representative of all the fluctuations in environmental quality or capture unique occurrences. While one might expect health risks pertaining to historic or future conditions at this site to be similar to those described in this report, the health risk assessment is limited to 1 September 2009 through the 2011 withdrawal of U.S. Forces.

The POEMS can be useful to inform healthcare providers and others of environmental conditions experienced by individuals deployed to Camp Taji during the period of this assessment. However, it does not represent an individual exposure profile. Individual exposures depend on many variables such as; how long, how often, where and what someone is doing while working and/or spending time outside. Individual outdoor activities and associated routes of exposure are extremely variable and cannot be identified from or during environmental sampling. Individuals who sought medical treatment related to OEH exposures while deployed should have exposure/treatment noted in their medical record on a Standard Form (SF) 600 (Chronological Record of Medical Care).

**SITE DESCRIPTION:**

Camp Taji (originally Al Taji Army Airfield) was located approximately 20 - 30 km northwest of Baghdad, near the city of Taji (population 144,000). Before the war, the site was a huge military/industrial facility. Camp Taji was divided with Iraqi and U.S. sides. Camp Taji was bordered by canals to the north and south, by railroad tracks to the west, the Tigris River to the east, and was bisected by Highway 1 (MSR Tampa). The surrounding area was primarily small farms and villages. There was a market area to the southwest and a large industrial complex, the Al Samud Plant, about 3 km north along Highway 1. Most cultivated land was irrigated by a system of canals and ditches, some well-prepared and concrete lined, others merely ditches in the soil. The U.S. forces at Taji included approximately 11,000 personnel, a majority of which were Army personnel. The camp also houses Coalition Forces and New Iraqi Army personnel.

**SUMMARY:** Conditions that may pose a Moderate or greater health risk are summarized in Table 1. Table 2 provides population based risk estimates for identified OEH conditions at Camp Taji. As indicated in the detailed sections that follow Table 2, controls established to reduce health risk were factored into this assessment. In some cases, e.g. ambient air, specific controls are noted, but not routinely available/feasible.

**Table 1: Summary of Occupational and Environmental Conditions with MODERATE or Greater Health Risk**

**Short-term health risks & medical implications:** The following hazards may be associated with potential acute effects in some personnel during deployment at Camp Taji, Iraq:

Inhalable coarse particulate matter less than 10 micrometers in diameter ( $PM_{10}$ ); food/waterborne diseases (e.g., bacterial diarrhea, Hepatitis A, Typhoid/paratyphoid fever, diarrhea-protozoal, diarrhea-cholera, Brucellosis, Hepatitis E); other endemic diseases (cutaneous leishmaniasis, Crimean-Congo hemorrhagic fever, Sandfly fever, Tuberculosis (TB), Leptospirosis, Schistosomiasis, Rabies, Q fever); venomous animals and insects, heat stress; and burn pits. For food/waterborne diseases (e.g., bacterial diarrhea, Hepatitis A, Typhoid/paratyphoid fever, diarrhea-protozoal, diarrhea-cholera, Brucellosis, Hepatitis E), if ingesting food and water off post, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (Hepatitis A, Typhoid fever, Hepatitis E, and Brucellosis). Risks from food/waterborne diseases may have been reduced with preventive medicine controls and mitigation, which includes Hepatitis A and Typhoid fever vaccinations, and only drinking from approved water sources in accordance with standing CENTCOM policy. For other vector-borne endemic diseases (cutaneous leishmaniasis, Crimean-Congo hemorrhagic fever, Sandfly fever), these diseases may constitute a significant risk due to exposure to biting vectors; risk was reduced to low by proper wear of treated uniform, application of repellent to exposed skin, and appropriate chemoprophylaxis. For respiratory diseases (Tuberculosis (TB)), personnel in close-quarter conditions could have been at risk for person-to-person spread. For water-contact diseases (Leptospirosis, Schistosomiasis), activities involving extensive contact with surface water increase risk. Animal contact diseases (Rabies, Q fever), pose year-round risk. For venomous animals and insects (specifically spiders, scorpions, and snakes), if encountered, effects of venom vary with species from mild localized swelling to potentially lethal effects. For heat stress, risk can be greater for susceptible persons including those older than 45, of low fitness level, unacclimatized personnel, or individuals with underlying medical conditions. Risks from heat stress may have been reduced with preventive medicine controls, proper work-rest cycles, and mitigation.

Air quality: For inhalational exposure to high levels of dust and  $PM_{10}$ , such as during high winds or dust storms, exposures may result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel while at this site, and certain subgroups of the deployed forces (e.g., those with pre-existing asthma/respiratory and cardiopulmonary conditions) were at greatest risk of developing notable health effects. Likewise, for burn pits, exposures to high levels of  $PM_{10}$  in the smoke may also result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups while at this site. Although most effects from exposure to  $PM_{10}$  and to burn pit smoke should have resolved post-deployment, providers should be prepared to consider the relationship between deployment exposures and current complaints. Some individuals may have sought treatment for acute respiratory irritation during their time at Camp Taji, Iraq. Personnel who reported with symptoms or required treatment while at this site should have exposure/treatment noted in medical record (e.g., electronic medical record or on a Standard Form (SF) 600 (*Chronological Record of Medical Care*)).

**Long-term health risks & medical implications:** The following hazards may be associated with potential chronic health effects in some personnel during deployment at Camp Taji, Iraq:

Inhalable particulate matter less than 2.5 micrometers in diameter ( $PM_{2.5}$ ) and Leishmaniasis-visceral infection. Leishmaniasis is transmitted by sand flies. Visceral leishmaniasis (a more latent form of the disease) causes a severe febrile illness, which typically requires hospitalization with convalescence over 7 days. The leishmaniasis parasites may survive for years in infected individuals. Consequently, this infection may go unrecognized until infections become symptomatic years later.

Air Quality: It is considered possible that some otherwise healthy personnel who were exposed for a long-term period to particulate matter less than 2.5 micrometers in diameter ( $PM_{2.5}$ ) could develop certain health conditions (e.g., reduced lung function, cardiopulmonary disease). Personnel with a history of asthma or cardiopulmonary disease could potentially be more likely to develop such chronic health conditions. While the  $PM$  exposures were documented and archived, at this time there were no specific recommended, post-deployment medical surveillance evaluations or treatments. Providers should still consider overall individual health status (e.g., any underlying conditions/susceptibilities) and any potential unique individual exposures (such as burn pits, or occupational or specific personal dosimeter data) when assessing individual concerns. Certain individuals may need to be followed/evaluated for specific occupational exposures/injuries (e.g., annual audiograms as part of the medical surveillance for those enrolled in the Hearing Conservation Program; and personnel covered by Respiratory Protection Program and/or Hazardous Waste/Emergency Responders Medical Surveillance).

**Table 2. Population-Based Health Risk Estimates - Camp Taji, Iraq**<sup>1,2</sup>

Source of Identified Health Risk <sup>3</sup>	Unmitigated Health Risk Estimate <sup>4</sup>	Control Measures Implemented	Residual Health Risk Estimate <sup>4</sup>
<b>AIR</b>			
Particulate matter less than 10 microns in diameter (PM <sub>10</sub> )	Short-term: Low to Moderate, Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: Low to Moderate, Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).
	Long-term: No health guidelines		Long-term: No health guidelines
Particulate matter less than 2.5 microns in diameter (PM <sub>2.5</sub> )	Short-term: Low, A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: Low, A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.
	Long-term: Moderate. A small percentage of personnel may be at increased risk for developing chronic conditions. Particularly those more susceptible to acute effects (e.g., those with asthma/existing respiratory diseases).		Long-term: Moderate. A small percentage of personnel may be at increased risk for developing chronic conditions. Particularly those more susceptible to acute effects (e.g., those with asthma/existing respiratory diseases).
<b>ENDEMIC DISEASE</b>			
Food borne/Waterborne (e.g., diarrhea-bacteriological)	Short-term: Variable, High (bacterial diarrhea, hepatitis A, typhoid fever) to Moderate (diarrhea-cholera, diarrhea- protozoal, brucellosis and hepatitis E). If local food/water were consumed, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (Hepatitis A, Typhoid fever, Brucellosis, Hepatitis E).	Preventive measures include Hepatitis A and Typhoid fever vaccination and consumption of food and water only from approved sources.	Short-term: Low to none
	Long-term: none identified		Long-term: No data available
Arthropod Vector Borne	Short-term: Variable, Moderate for leishmaniasis-cutaneous, Crimean-Congo hemorrhagic fever, and sandfly fever; Low for West Nile fever, sindbis, rickettsioses-tickborne, and typhus-murine (fleaborne).	Preventive measures include proper wear of treated uniform, application of repellent to exposed skin, and bed net use, minimizing areas of standing water and appropriate chemoprophylaxis.	Short-term: Low
	Long-term: Low (Leishmaniasis-visceral infection)		Long-term: No data available
Water-Contact (e.g. wading, swimming)	Short-term: Moderate for leptospirosis and schistosomiasis.		Short-term: Moderate for leptospirosis and schistosomiasis.
	Long-term: No data available		Long-term: No data available
Respiratory	Short-term: Variable; Moderate for tuberculosis (TB) to Low for meningococcal meningitis.	Providing adequate living and work space; medical screening; vaccination	Short-term: Low
	Long-term: No data available		Long-term: No data available

Source of Identified Health Risk <sup>3</sup>	Unmitigated Health Risk Estimate <sup>4</sup>	Control Measures Implemented	Residual Health Risk Estimate <sup>4</sup>
Animal Contact	Short-term: Variable; Moderate for rabies and Q-fever, and Low for Anthrax and H5N1 avian influenza.	Prohibiting contact with, adoption, or feeding of feral animals IAW U.S. Central Command (CENTCOM) General Order (GO) 1B. Risks are further reduced in the event of assessed contact by prompt post-exposure rabies prophylaxis IAW The Center for Disease Control's (CDC) Advisory Committee on Immunization Practices guidance.	Short-term: No data available
	Long-term: Low (Rabies)		Long-term: No data available
<b>VENOMOUS ANIMAL/ INSECTS</b>			
Snakes, scorpions, and spiders	Short-term: Variable, Low; If encountered, effects of venom vary with species from mild localized swelling (e.g. <i>Scorpio maurus</i> ) to High, potentially lethal effects (e.g. <i>Vipera albicornuta</i> ).	Risk reduced by avoiding contact, proper wear of uniform (especially footwear), and proper and timely treatment.	Short-term: Variable, Low; If encountered, effects of venom vary with species from mild localized swelling (e.g. <i>Scorpio maurus</i> ) to High, potentially lethal effects (e.g. <i>Vipera albicornuta</i> ).
	Long-term: No data available		Long-term: No data available
<b>HEAT/COLD STRESS</b>			
Heat	Short-term: Variable; Risk of heat injury is High for April – October, Moderate for November – March, and Low for December - February.	Work-rest cycles, proper hydration and nutrition, and Wet Bulb Globe Temperature (WBGT) monitoring.	Short-term: Variable; Risk of heat injury in unacclimatized or susceptible personnel is High for April – October, Moderate for November – March, and Low for December - February.
	Long-term: Low, The long-term risk was Low. However, the risk may be greater to certain susceptible persons—those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.		Long-term: Low, The long-term risk is Low. However, the risk may be greater to certain susceptible persons—those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.
Cold	Short-term: Low risk of cold stress/injury.	Risks from cold stress reduced with protective measures such as use of the buddy system, limiting exposure during cold weather, proper hydration and nutrition, and proper wear of issued protective clothing.	Short-term: Low risk of cold stress/injury.
	Long-term: Low; Long-term health implications from cold injuries are rare but can occur, especially from more serious injuries such as frost bite.		Long-term: Low; Long-term health implications from cold injuries are rare but can occur, especially from more serious injuries such as frost bite.
<b>NOISE</b>			
Continuous (Flightline, Power Production)	Short-term: Low	Hearing protection used by personnel in higher risk areas	Short-term: Low
	Long-term: Low		Long-term: Low

Source of Identified Health Risk <sup>3</sup>	Unmitigated Health Risk Estimate <sup>4</sup>	Control Measures Implemented	Residual Health Risk Estimate <sup>4</sup>
Impulse	Short-term: Low	Hearing protection used by personnel in higher risk areas	Short-term: Low
	Long-term: Low		Long-term: Low
<b>Unique Incidents/ Concerns</b>			
<b>Burn Pits</b>  Particulate matter less than 10 microns in diameter (PM <sub>10</sub> )	Short-term: Low to Moderate, Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: Low to Moderate, Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).
	Long-term: No health guidelines		Long-term: No health guidelines
<b>Burn Pits</b>  Particulate matter less than 2.5 microns in diameter (PM <sub>2.5</sub> )	Short-term: Low, A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: Low, A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.
	Long-term: Low. A small percentage of personnel may be at increased risk for developing chronic conditions. Particularly those more susceptible to acute effects (e.g., those with asthma/existing respiratory diseases).		Long-term: Low. A small percentage of personnel may be at increased risk for developing chronic conditions. Particularly those more susceptible to acute effects (e.g., those with asthma/existing respiratory diseases).

<sup>1</sup> This Summary Table provides a qualitative estimate of population-based short and long-term health risks associated with the general ambient and occupational environment conditions at Camp Taji. It does not represent a unique individual exposure profile. Actual individual exposures and health effects depend on many variables. For example, while a chemical may be present in the environment, if a person does not inhale, ingest, or contact a specific dose of the chemical for adequate duration and frequency, then there may be no health risk. Alternatively, a person at a specific location may experience a unique exposure which could result in a significant individual exposure. Any such person seeking medical care should have their specific exposure documented in their medical record (e.g., electronic medical record or on a Standard Form (SF) 600 (*Chronological Record of Medical Care*)).

<sup>2</sup> This assessment was based on specific data and reports obtained from the 1 September 2009 to 1 September 2011 timeframe. It was considered a current representation of general site conditions but may not reflect certain fluctuations or unique exposure incidents. Acute health risk estimates were generally consistent with field-observed health effects.

<sup>3</sup> This Summary Table was organized by major categories of identified sources of health risk. It only lists those sub-categories specifically identified and addressed at Camp Taji. The health risks are presented as Low, Moderate, High or Extremely High for both acute and chronic health effects. The risk level was based on an assessment of both the potential severity of the health effects that could be caused and probability of the exposure that would produce such health effects. Details can be obtained from the APHC/AIPH. Where applicable, "None Identified" was used when though an exposure was identified, no risk of either a specific acute or chronic health effects were determined. More detailed descriptions of OEH exposures that were evaluated but determined to pose no health risk are discussed in the following sections of this report.

<sup>4</sup> Risks in this Summary Table were based on quantitative surveillance thresholds (e.g. endemic disease rates; host/vector/pathogen surveillance) or screening levels, e.g. Military Exposure Guidelines (MEG) for chemicals. Some previous assessment reports may provide slightly inconsistent risk estimates because quantitative criteria such as MEGs may have changed since the samples were originally evaluated and/or because this assessment makes use of all historic site data while previous reports may have only been based on a select few samples.

## 1 Discussion of Health Risks at Camp Taji, Iraq by Source

The following sections describe the major source categories of potential health risk that were evaluated at Camp Taji for the 1 September 2009 to 1 September 2011 timeframe. For each category, the evaluation process includes identifying what, if any, specific sub-categories/health concerns were present. This initial step results in “screening out” certain sub-categories that pose no identifiable health risk (for example if all data were below screening levels). While these sections may include sub-categories that have been determined to present no identifiable health risk, the summary table on the previous page only contains those sub-categories that were determined to pose a Moderate or higher level of potential health risk.

## 2 Air

### 2.1 Site-Specific Sources Identified

Camp Taji is situated in a dusty semi-arid environment. Personnel deployed to Camp Taji were exposed to various airborne constituents. Windblown dust, industrial pollution, and sand contribute to PM exposures. There were a number of industrial activities including fuel storage and distribution, airfield flight operations, water and wastewater treatment, and concrete and asphalt production, located on and around Camp Taji that may contribute to air contaminants such as dust, metals and chemical gases. Additional exposures from the Army’s use of open burn pits to dispose of waste/refuse such as paper, plastic, and wood may also occur. The risk assessment for air samples taken near the burn pits are presented in Section 10.7. All other samples obtained were used to represent the overall ambient air conditions of the site, and are presented below.

### 2.2 Particulate matter

Particulate matter (PM) is a complex mixture of extremely small particles suspended in the air. The PM includes 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 sand, soil, metals, volatile organic compounds (VOC), allergens, and other compounds such as nitrates or sulfates that are formed by condensation or transformation of combustion exhaust. The PM composition and particle size vary considerably depending on the source. Generally, PM of health concern is divided into two fractions: PM<sub>10</sub>, which includes coarse particles with a diameter of 10 micrometers or less, and fine particles less than 2.5 micron (PM<sub>2.5</sub>), which can reach the deepest regions of the lungs when inhaled. Exposure to excessive PM is linked to a variety of potential health effects.

### 2.3 Particulate matter, less than 10 micrometers (PM<sub>10</sub>)

#### 2.3.1 Exposure Guidelines:

Short Term (24-hour) PM<sub>10</sub> (µg/m<sup>3</sup>):

- Negligible MEG = 250
- Marginal MEG = 420
- Critical MEG = 600

Long-term PM<sub>10</sub> MEG (µg/m<sup>3</sup>):

- Not defined and not available.

### 2.3.2 Sample data/Notes:

A total of 45 valid PM<sub>10</sub> air samples were collected from 21 September 2009 to 2 July 2010. The range of 24-hour PM<sub>10</sub> concentrations was 22 µg/m<sup>3</sup> to 1051 µg/m<sup>3</sup> with an average concentration of 214 µg/m<sup>3</sup>.

### 2.3.3 Short-term health risks:

**Low to Moderate:** The PM<sub>10</sub> average concentration (214 µg/m<sup>3</sup>) was below the short-term PM<sub>10</sub> negligible MEG of 250 µg/m<sup>3</sup> and was not considered a health hazard. However, the peak PM<sub>10</sub> concentration (1051 µg/m<sup>3</sup>) was greater than the short-term PM<sub>10</sub> critical MEG of 600 µg/m<sup>3</sup>. The short-term risk assessment for peak PM<sub>10</sub> concentration was Moderate. Therefore, PM<sub>10</sub> was not expected to pose a short-term health risk to personnel on typical days, but peak exposures can occur, increasing the health risk level to Moderate. Daily average risk levels show no hazard for 76%, low risk for 17%, moderate risk for 2%, and high risk for 5% of the time. Confidence in the short-term PM<sub>10</sub> risk assessment was medium (Reference 9, Table 3-6).

The hazard severity for average PM<sub>10</sub> concentrations in samples was negligible. The results indicate that exposure to PM<sub>10</sub> was expected to have little or no impact on mission readiness. No specific medical action required for typical exposures (Reference 9, Table 3-10).

For the highest observed PM<sub>10</sub> sample concentration, the hazard severity was critical. During peak exposures at the critical hazard severity level, personnel may experience very notable eye, nose, and throat irritation and respiratory effects. Visual acuity may be impaired, as well as overall aerobic capacity. Those with a history of asthma or cardiopulmonary disease may experience more severe symptoms (Reference 9, Table 3-10).

### 2.3.4 Long-term health risk:

**Not Evaluated-no available health guidelines.** The U. S. Environmental Protection Agency (EPA) has retracted its long-term standard (national ambient air quality standards, NAAQS) for PM<sub>10</sub> due to an inability to clearly link chronic health effects with chronic PM<sub>10</sub> exposure levels.

## 2.4 Particulate Matter, less than 2.5 micrometers (PM<sub>2.5</sub>)

### 2.4.1 Exposure Guidelines:

Short Term (24-hour) PM<sub>2.5</sub> (µg/m<sup>3</sup>):

- Negligible MEG = 65
- Marginal MEG = 250
- Critical MEG = 500

Long-term (1year) PM<sub>2.5</sub> MEGs (µg/m<sup>3</sup>):

- Negligible MEG = 15
- Marginal MEG = 65.

### 2.4.2 Sample data/Notes:

A total of 12 valid PM<sub>2.5</sub> air samples were collected from 19 September 2009 to 17 October 2010. The range of 24-hour PM<sub>2.5</sub> concentrations was 19 µg/m<sup>3</sup> to 832 µg/m<sup>3</sup>, with an average concentration of 161 µg/m<sup>3</sup>.

### 2.4.3 Short-term health risks:

**Low:** The short-term PM<sub>2.5</sub> health risk assessment is Low based on average and peak concentrations, and the likelihood of exposure at these hazard severity levels. A Low health risk assessment is expected to have little or no impact on mission readiness (Reference 9, Table 3-2). Daily average risk levels for PM<sub>2.5</sub> show no hazard for 50%, low risk for 40%, and high risk for 10% of the time. Confidence in short-term PM<sub>2.5</sub> risk assessment was low (Reference 9, Table 3-6).

The hazard severity was negligible (65µg/m<sup>3</sup> - 250µg/m<sup>3</sup>) for average PM<sub>2.5</sub> exposures. The results predict that a few personnel may experience notable eye, nose, and throat irritation; most personnel will experience only mild effects. Pre-existing health conditions (e.g., asthma or cardiopulmonary diseases) may be exacerbated (Reference 9, Table 3-10).

For the highest observed PM<sub>2.5</sub> exposure, the hazard severity was critical (> 500µg/m<sup>3</sup>). During peak exposures at the critical hazard severity level, most if not all personnel experience very notable eye, nose, and throat irritation and respiratory effects. Visual acuity may be impaired, as well as overall aerobic capacity. Some personnel will not be able to perform assigned duties. Lost duty days were expected. Those with a history of asthma or cardiopulmonary disease will experience more severe symptoms (Reference 9, Table 3-10).

### 2.4.4 Long-term health risks:

**Moderate:** The long-term health risk assessment was moderate for average PM<sub>2.5</sub> concentration. A Moderate risk level for typical exposure concentrations suggests that long-term exposure to PM<sub>2.5</sub> at Camp Taji may require limited future medical surveillance activities and related resources. Confidence in the long-term PM<sub>2.5</sub> risk assessment was low (Reference 9, Table 3-6).

The hazard severity was marginal (>65 µg/m<sup>3</sup>) for average PM<sub>2.5</sub> sample concentrations. The results suggest that with repeated exposures above the marginal hazard severity threshold, it is plausible that development of chronic health conditions such as reduced lung function or exacerbated chronic bronchitis, chronic obstructive pulmonary disease (COPD), asthma, atherosclerosis, or other cardiopulmonary diseases could occur in generally healthy troops. Those with a history of asthma or cardiopulmonary disease were considered to be at particular risk. This guideline was an uncertain screening value - it was not a known health effects concentration (Reference 9, Table 3-10).

## 2.5 PM<sub>10</sub> Airborne Metals

### 2.5.1 Exposure Guidelines:

No PM<sub>10</sub> airborne metal concentrations exceeded the short and long-term MEGs.

### 2.5.2 Sample data/Notes:

The airborne metals risk assessment was based on 44 valid air samples collected from 21 September 2009 to 2 July 2010. None of the analyzed metals in the samples were found at concentrations above the 1-year negligible MEGs.



### 2.5.3 Short-term and long-term health risk:

**None identified based on available sample data.** All collected samples were below the short and long-term Negligible MEGs.

## 3 Soil

### 3.1 Sample data/Notes:

A total of 4 surface soil samples were collected from 18 January 2010 through 18 October 2010 to assess OEHR risk to deployed personnel. The primary soil contamination exposure pathways were dermal contact and dust inhalation. Typical parameters analyzed for included SVOCs, heavy metals, PCBs, pesticides, herbicides. If the contaminant was known or suspected, other parameters may have been analyzed for (i.e. total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAH) near fuel spills). The percent of the population exposed to soil and associated dust in the sampled areas was > 75% for 3 samples and < 10% for 1 sample. For the risk assessment, personnel are assumed to remain at this location for 6 months to 1 year. None of the analyzed parameters in the samples were found at concentrations above the 1-year negligible MEGs.

### 3.2 Short-term health risk:

**Not an identified source of health risk.** Currently, sampling data for soil are not evaluated for short term (acute) health risks.

### 3.3 Long-term health risk:

**None identified based on available sample data.** No parameters exceeded 1-year Negligible MEGs.

## 4 Water

In order to assess the risk to U.S. personnel from exposure to water in theater, the APHC/AIPH identified the most probable exposure pathways. These are based on the administrative information provided on the field data sheets submitted with the samples taken over the time period being evaluated. Based on the information provided from the field, all samples of untreated water were associated with source water for treatment and no exposure pathways were associated with those samples. Therefore, untreated samples are not assessed as potential health hazards. It was assumed that 100% of U.S. personnel at Camp Taji will be directly exposed to Reverse Osmosis Water Purification Unit (ROWPU) treated/disinfected fresh bulk water, since this classification of water was primarily used for personal hygiene, showering, cooking, and for use at vehicle wash racks. Field data sheets indicate that bottled water is the only source of drinking water.

### 4.1 Non-Drinking Water: ROWPU

#### 4.1.1 Site-Specific Sources Identified

Although the primary route of exposure for most microorganisms is ingestion of contaminated water, dermal exposure to some microorganisms, chemicals, and biologicals may also cause adverse health effects. Complete exposure pathways would include drinking, brushing teeth, personal hygiene,

cooking, providing medical and dental care using a contaminated water supply or during dermal contact at vehicle or aircraft wash racks.

#### 4.1.2 Sample data/Notes:

To assess the potential for adverse health effects to troops the following assumptions were made about dose and duration: All U.S. personnel at this location were assumed to remain at this site for approximately 1 year. A conservative (protective) assumption is that personnel routinely consumed less than 5L/day of non-drinking water for up to 365 days (1-year). It is further assumed that control measures and/or personal protective equipment were not used. A total of 9 disinfected bulk water (non-drinking) samples from 1 September 2009 to 1 September 2011 were evaluated for this health risk assessment. No health risks from ROWPU-treated (non-drinking) exposures were identified based on the limited sample data.

#### 4.1.3 Short and long-term health risks:

**None identified based on available sample data.** All collected samples were below the short and long-term Negligible MEGs.

## 5 Military Unique

### 5.1 Chemical Biological, Radiological Nuclear (CBRN) Weapons

No specific hazard sources were documented in the Defense Occupational and Environmental Health Readiness System (DOEHRS), or the Military Environmental Surveillance Library (MESL) from 1 September 2009 through 1 September 2011.

### 5.2 Depleted Uranium (DU)

No specific hazard sources were documented in the DOEHRS or MESL from 1 September 2009 through 1 September 2011.

### 5.3 Ionizing Radiation

No specific hazard sources were documented in the DOEHRS or MESL from 1 September 2009 through 1 September 2011.

### 5.4 Non-Ionizing Radiation

No specific hazard sources were documented in the DOEHRS or MESL from 1 September 2009 through 1 September 2011.

## 6 Endemic Disease

This document lists the endemic diseases reported in the region, its specific health risks and severity and general health information about the diseases. USCENTCOM MOD 11 (Reference 11) lists deployment requirements, to include immunizations and chemoprophylaxis, in effect during the timeframe of this POEMS.

## 6.1 Foodborne and Waterborne Diseases

Food borne and waterborne diseases in the area are transmitted through the consumption of local food and water. Local unapproved food and water sources (including ice) are heavily contaminated with pathogenic bacteria, parasites, and viruses to which most U.S. Service Members have little or no natural immunity. Effective host nation disease surveillance does not exist within the country. Only a small fraction of diseases are identified or reported in host nation personnel. Diarrheal diseases are expected to temporarily incapacitate a very high percentage of U.S. personnel within days if local food, water, or ice is consumed. Hepatitis A and typhoid fever infections typically cause prolonged illness in a smaller percentage of unvaccinated personnel. Vaccinations are required for DOD personnel and contractors. In addition, although not specifically assessed in this document, significant outbreaks of viral gastroenteritis (e.g., norovirus) and food poisoning (e.g., *Bacillus cereus*, *Clostridium perfringens*, *Staphylococcus*) may occur. Key disease risks are summarized below:

Mitigation strategies were in place and included consuming food and water from approved sources, vaccinations (when available), frequent hand washing, and general sanitation practices.

### 6.1.1 Diarrheal diseases (bacteriological)

**High, mitigated to Low:** Diarrheal diseases can be expected to temporarily incapacitate a very high percentage of personnel (potentially over 50% per month) within days if local food, water, or ice was consumed. Field conditions (including lack of hand washing and primitive sanitation) may facilitate person-to-person spread and epidemics. Typically mild disease treated in outpatient setting; recovery and return to duty in less than 72 hours with appropriate therapy. A small proportion of infections may require greater than 72 hours limited duty, or hospitalization.

### 6.1.2 Hepatitis A, typhoid/paratyphoid fever, and diarrhea-protozoal

**High, mitigated to Low:** Unmitigated health risk to U.S. personnel is high year round for hepatitis A and typhoid/paratyphoid fever, and Moderate for diarrhea-protozoal. Mitigation was in place to reduce the risks to low. Hepatitis A, typhoid/paratyphoid fever, and diarrhea-protozoal disease may cause prolonged illness in a small percentage of personnel (less than 1% per month). Although much rarer, other potential diseases in this area that are also considered a Moderate risk include: hepatitis E, diarrhea-cholera, and brucellosis.

### 6.1.3 Short-term Health Risks:

**Low:** The overall unmitigated short-term risk associated with food borne and waterborne diseases are considered High (bacterial diarrhea, hepatitis A, typhoid/paratyphoid fever) to Moderate (diarrhea-cholera, diarrhea-protozoal, brucellosis) to Low (hepatitis E) if local food or water is consumed. Preventive Medicine measures reduced the risk to Low. Confidence in the health risk estimate was high.

### 6.1.4 Long-term Health Risks:

**None identified based on available data.**

## 6.2 Arthropod Vector-Borne Diseases

During the warmer months, the climate and ecological habitat support populations of arthropod vectors, including mosquitoes, ticks, mites, and sandflies. Significant disease transmission is sustained countrywide, including urban areas. Mitigation strategies were in place and included proper wear of treated uniforms, application of repellent to exposed skin, and use of bed nets and chemoprophylaxis (when applicable). Additional methods included the use of pesticides, reduction of pest/breeding habitats, and engineering controls.

#### 6.2.1 Malaria

**None:** Indigenous transmission of malaria in Iraq was eliminated as of 2008 reducing risk among personnel exposed to mosquito bites to None.

#### 6.2.2 Leishmaniasis

**Moderate, mitigated to Low:** The disease risk is Moderate during the warmer months when sandflies are most prevalent, but reduced to low with mitigation measures. Leishmaniasis is transmitted by sand flies. There are two forms of the disease; cutaneous (acute form) and visceral (a more latent form of the disease). The leishmaniasis parasites may survive for years in infected individuals and this infection may go unrecognized by physicians in the U.S. when infections become symptomatic years later. Cutaneous infection is unlikely to be debilitating, though lesions may be disfiguring. Visceral leishmaniasis disease can cause severe febrile illness which typically requires hospitalization with convalescence over 7 days.

#### 6.2.3 Crimean-Congo hemorrhagic fever

**Moderate, mitigated to Low:** Unmitigated risk is moderate, but reduced to low with mitigation measures. Crimean-Congo hemorrhagic fever occurs in rare cases (less than 0.1% per month attack rate in indigenous personnel) and is transmitted by tick bites or occupational contact with blood or secretions from infected animals. The disease typically requires intensive care with fatality rates from 5% to 50%.

#### 6.2.4 Sandfly fever

**Moderate, mitigated to Low:** Sandfly fever has a Moderate risk with potential disease rates from 1% to 10% per month under worst case conditions. Mitigation measures reduced the risk to low. The disease is transmitted by sandflies and occurs more commonly in children though adults are still at risk. Sandfly fever disease typically resulted in debilitating febrile illness requiring 1 to 7 days of supportive care followed by return to duty.

#### 6.2.5 Sindbis (and Sindbis-like viruses)

**Low:** Sindbis and sindbis-like viruses are maintained in a bird-mosquito cycle in rural areas and occasionally caused limited outbreaks among humans. The viruses are transmitted by a variety of *Culex* mosquito species found primarily in rural areas. A variety of bird species may serve as reservoir or amplifying hosts. Extremely rare cases (less than 0.01% per month attack rate) could have occurred seasonally (April - November). Debilitating febrile illness often accompanied by rash, typically requires 1 to 7 days of supportive care; significant arthralgias may persist for several weeks or more in some cases. This disease is associated with a low health risk estimate.

#### 6.2.6 Rickettsioses, tickborne (spotted fever group)

**Low:** Rare cases (less than 0.1% per month) of **rickettsioses** disease are possible among personnel exposed to tick bites. Rickettsioses are transmitted by multiple species of hard ticks, including *Rhipicephalus* spp., which are associated with dogs. Other species of ticks, including *Ixodes* are also capable of transmitting rickettsial pathogens in this group. In addition to dogs, various rodents and other animals also may serve as reservoirs. Ticks are most prevalent from April through November. Incidents can result in debilitating febrile illness, which may require 1 to 7 days of supportive care followed by return to duty. The health risk of rickettsial disease is Low.

#### 6.2.7 Typhus-murine (fleaborne)

**Low:** Typhus-murine has a Low risk estimate and is assessed as present, but at unknown levels. Rare cases are possible among personnel exposed to rodents (particularly rats) and flea bites. Incidents may result in debilitating febrile illness typically requiring 1 to 7 days of supportive care followed by return to duty.

#### 6.2.8 West Nile fever

**Low:** West Nile fever is present. The disease is maintained by the bird population and transmitted to humans via mosquito vector. Typically, infections in young, healthy adults were asymptomatic although fever, headache, tiredness, body aches (occasionally with a skin rash on trunk of body), and swollen lymph glands can occur. This disease is associated with a low risk estimate.

#### 6.2.9 Short -term health risks:

**Low:** The unmitigated risk is moderate for leishmaniasis - cutaneous (acute), Crimean-Congo hemorrhagic fever, and sandfly fever; Low for, sindbis, rickettsioses-tickborne, typhus-fleaborne, and West Nile fever. No hazard from malaria (2008 - 2011). Risk is reduced to Low by proper wear of the uniform and application of repellent to exposed skin. Confidence in the risk estimate is high.

#### 6.2.10 Long -term health risks:

**Low:** The unmitigated risk is moderate for leishmaniasis-visceral (chronic). Risk is reduced to Low by proper wear of the uniform and application of repellent to exposed skin. Confidence in the risk estimate is high.

### 6.3 Water Contact Diseases

Tactical operations or recreational activities that involve extensive contact with surface water such as lakes, streams, rivers, or flooded fields may result in significant exposure to leptospirosis and schistosomiasis. Arid portions of Iraq without permanent or persistent bodies of surface water do not support transmission of leptospirosis or schistosomiasis. Risk was restricted primarily to areas along rivers and lakes. These diseases can debilitate personnel for up to a week or more. Leptospirosis risk typically increases during flooding. In addition, although not specifically assessed in this document, bodies of surface water are likely to be contaminated with human and animal waste. Activities such as wading or swimming may result in exposure to enteric diseases including diarrhea and hepatitis via incidental ingestion of water. Prolonged water contact also may lead to the development of a variety of potentially debilitating skin conditions including bacterial or fungal dermatitis. Mitigation strategies

were in place and included avoiding water contact and recreational water activities, proper wear of uniform (especially footwear), and protective coverings for cuts/abraded skin.

### 6.3.1 Leptospirosis

**Moderate, mitigated to Low:** Human infections occur seasonally (typically April through November) through exposure to water or soil contaminated by infected animals and is associated with wading and swimming in contaminated, untreated open water. The occurrence of flooding after heavy rainfall facilitates the spread of the organism because as water saturates the environment leptospirosis present in the soil passes directly into surface waters. Leptospirosis can enter the body through cut or abraded skin, mucous membranes, and conjunctivae. Infection may also occur from ingestion of contaminated water. The acute, generalized illness associated with infection may mimic other tropical diseases (for example, dengue fever, malaria, and typhus), and common symptoms include fever, chills, myalgia, nausea, diarrhea, cough, and conjunctival suffusion. Manifestations of severe disease can include jaundice, renal failure, hemorrhage, pneumonitis, and hemodynamic collapse. Recreational activities involving extensive water contact may result in personnel being temporarily debilitated with leptospirosis. This disease is associated with a Moderate health risk estimate.

### 6.3.2 Schistosomiasis

**Moderate, mitigated to Low:** Humans are the principal reservoir for schistosomes; humans shed schistosome eggs in urine or feces. Animals such as cattle and water buffalo may also be significant reservoirs. Rare cases (less than 0.1% per month attack rate) may occur seasonally (typically April through November) among personnel wading or swimming in lakes, streams, or irrigated fields which were frequently contaminated with human and animal waste containing schistosome eggs. In groups with prolonged exposure to heavily contaminated foci, attack rates may exceed 10%. Exceptionally heavy concentrations of schistosomes may occur in discrete foci, which were difficult to distinguish from less contaminated areas. In non-immune personnel exposed to such foci, rates of acute schistosomiasis may be over 50%. Mild infections are generally asymptomatic. In very heavy acute infections, a febrile illness (acute schistosomiasis) may occur, especially with *Schistosoma japonicum* and *S. mansoni*, requiring hospitalization and convalescence over 7 days. This disease is associated with a Moderate health risk estimate.

### 6.3.3 Short -term health risks:

**Low:** Unmitigated health risk of schistosomiasis and leptospirosis is Moderate during warmer months. Mitigation measures reduce the risk to Low. Confidence in the health risk estimate is high.

### 6.3.4 Long -term health risks:

**None identified based on available data.**

## 6.4 Respiratory Diseases

Although not specifically assessed in this document, deployed U.S. forces may be exposed to a wide variety of common respiratory infections in the local population. These include influenza, pertussis, viral upper respiratory infections, viral and bacterial pneumonia, and others. The U.S. military populations living in close-quarter conditions are at risk for substantial person-to-person spread of respiratory pathogens. Influenza is of particular concern because of its ability to debilitate large

numbers of unvaccinated personnel for several days. Mitigation strategies were in place and included routine medical screenings, vaccination, enforcing minimum space allocation in housing units, implementing head-to-toe sleeping in crowded housing units, implementation of proper Personal Protective Equipment (PPE) when necessary for healthcare providers and detention facility personnel.

#### 6.4.1 Tuberculosis (TB)

**Moderate, mitigated to Low:** Potential health risk to U.S. personnel is Moderate, mitigated to Low, year round. Transmission typically requires close and prolonged contact with an active case of pulmonary or laryngeal TB, although it also can occur with more incidental contact. The Army Surgeon General has defined increased risk in deployed Soldiers as indoor exposure to locals or third country nationals of greater than one hour per week in a highly endemic active TB region. Additional mitigation included active case isolation in negative pressure rooms, where available.

#### 6.4.2 Meningococcal meningitis

**Low:** Meningococcal meningitis poses a Low risk and is transmitted from person to person through droplets of respiratory or throat secretions. Close and prolonged contact facilitates the spread of this disease. Meningococcal meningitis is potentially a very severe disease typically requiring intensive care; fatalities may occur in 5-15% of cases.

#### 6.4.3 Short-term health risks:

**Low:** Moderate (TB) to Low (for meningococcal meningitis). Overall risk was reduced to Low with mitigation measures. Confidence in the health risk estimate is high.

#### 6.4.4 Long-term health risks:

**None identified based on available data.** Tuberculosis is evaluated as part of the Post Deployment Health Assessment (PDHA). A TB skin test is required post-deployment if potentially exposed and is based upon individual service policies.

### 6.5 Animal-Contact Diseases

#### 6.5.1 Rabies

**Moderate, mitigated to Low:** Rabies posed a year-round moderate risk. Occurrence in local animals was well above U.S. levels due to the lack of organized control programs. Dogs were the primary reservoir of rabies in Iraq, and a frequent source of human exposure. In June 2008, the New Jersey Health department in The United States reported a confirmed case of rabies in a mixed-breed dog recently imported from Iraq. Rabies is transmitted by exposure to the virus-laden saliva of an infected animal, typically through bites, but could occur from scratches contaminated with the saliva. No cases of rabies acquired in Iraq have been identified in US Service Members to date. The vast majority (>99%) of persons who develop rabies disease will do so within a year after a risk exposure, there have been rare reports of individuals presenting with rabies disease up to six years or more after their last known risk exposure. Mitigation strategies included command emphasis of CENTCOM GO 1B, reduction of animal habitats, active pest management programs, and timely treatment of feral animal scratches/bites.

### 6.5.2 Anthrax

**Low:** Anthrax cases are rare in indigenous personnel, and pose a Low risk to U.S. personnel. Anthrax is a naturally occurring infection; cutaneous anthrax is transmitted by direct contact with infected animals or carcasses, including hides. Eating undercooked infected meat may result in contracting gastrointestinal anthrax. Pulmonary anthrax is contracted through inhalation of spores and is extremely rare. Mitigation measures included consuming approved food sources, proper food preparation and cooking temperatures, avoidance of animals and farms, dust abatement when working in these areas, vaccinations, and proper PPE for personnel working with animals.

### 6.5.3 Q-Fever

**Moderate, mitigated to Low:** Potential health risk to U.S. personnel is Moderate, but mitigated to Low, year round. Rare cases are possible among personnel exposed to aerosols from infected animals, with clusters of cases possible in some situations. Significant outbreaks (affecting 1-50%) can occur in personnel with heavy exposure to barnyards or other areas where animals are kept. Unpasteurized milk may also transmit infection. The primary route of exposure is respiratory, with an infectious dose as low as a single organism. Incidence could result in debilitating febrile illness, sometimes presenting as pneumonia, typically requiring 1 to 7 days of inpatient care followed by return to duty. Mitigation strategies in place as listed in paragraph 6.5.2 except for vaccinations

### 6.5.4 H5N1 avian influenza

**Low:** Potential health risk to U.S. personnel is Low. Although H5N1 avian influenza (AI) is easily transmitted among birds, bird-to-human transmission is extremely inefficient. Human-to-human transmission appears to be exceedingly rare, even with relatively close contact. Extremely rare cases (less than 0.01% per month attack rate) could occur. Incidence could result in very severe illness with fatality rate higher than 50 percent in symptomatic cases. Mitigation strategies included avoidance of birds/poultry and proper cooking temperatures for poultry products.

### 6.5.5 Short-term health risks:

**Low:** Potential health risk to U.S. personnel is Low. Although H5N1 avian influenza (AI) is easily transmitted among birds, bird-to-human transmission is extremely inefficient. Human-to-human transmission appears to be exceedingly rare, even with relatively close contact. Extremely rare cases (less than 0.01% per month attack rate) could occur. Incidence could result in very severe illness with fatality rate higher than 50 percent in symptomatic cases. Mitigation strategies included avoidance of birds/poultry and proper cooking temperatures for poultry products.

### 6.5.6 Long-term health risks:

**Low:** A Low long term risk exists for rabies because, in rare cases, the incubation period for rabies can be several years.

## 7 Venomous Animal/Insect

All information was taken directly from the Clinical Toxinology Resources web site from the University



of Adelaide, Australia (Reference 2). The species listed below have home ranges that overlap the location of Camp Taji and vicinity, and may present a health risk if they are encountered by personnel. See Section 9 for more information about pesticides and pest control measures.

### 7.1 Spiders

- *Latrodectus pallidus*: Clinical effects uncertain, but related to medically important species, therefore major envenoming cannot be excluded.

### 7.2 Scorpions

- *Androctonus crassicauda* (black scorpion): Severe envenoming possible and potentially lethal, however most stings cause only severe local pain.
- *Buthacus leptochelys*, *B. macrocentrus*, *Compsobuthus matthiesseni*, *C. weneri*, *Mesobuthus caucasicus*, *M. eupeus*, *Odontobuthus doriae*, and *Orthochirus scrobiculosus*: Clinical effects unknown; there were a number of dangerous Buthid scorpions, but also others known to cause minimal effects only. Without clinical data it was unclear where this species fits within that spectrum.
- *Scorpio maurus*: Mild envenoming only, not likely to prove lethal. Stings by these scorpions were likely to cause only short lived local effects, such as pain, without systemic effects.
- *Hemiscorpius lepturus*: Severe envenoming possible, potentially lethal. Stings cause local necrosis and variable, sometimes fatal systemic effects, including haemolysis, cardiac failure, and central nervous system effects.
- *Hottentotta saulcyi*, *H. scaber*, and *H. schach*: Moderate envenoming possible but unlikely to prove lethal. Stings by these scorpions were likely to cause only short lived local effects, such as pain, without systemic effects.

### 7.3 Snakes

- *Cerastes gasperettii* (Gasperetti's horned sand viper): Potentially lethal envenoming, though unlikely. Bites may cause mild to moderate coagulopathy; severe coagulopathy not reported but cannot be excluded. Shock secondary to fluid shifts due to local tissue injury was possible in severe cases.
- *Hemorrhhis ravergeri* (mountain racer), *Malpolon monspessulanus* (hooded malpolon), *Psammophis schokari* (Schokari Sand Snake), and *Pseudocyclophis persicus* (Persian Horned Viper): Clinical effects unknown, but unlikely to cause significant envenoming. Bites likely to cause either no effects or only mild local effects.
- *Macrovipera lebetina euphratica* (Levantine viper), and *M. lebetina obtuse* (Levantine viper): Severe envenoming possible, potentially lethal. Moderate to severe coagulopathy and haemorrhagins causing extensive bleeding. Renal damage was a recognized complication, usually secondary to coagulopathy.
- *Platyceps rhodorachis* (Jan's desert racer), and *Psammophis lineolatus* (Steppe ribbon racer): Mild envenoming only, not likely to prove lethal.
- *Vipera albicornuta* (White-horned Viper): Severe envenoming possible, potentially lethal. Bites may cause mild to severe local effects, shock and coagulopathy.

- *Walterinnesia aegyptia* (Black Desert Cobra): Clinical effects unknown, but potentially lethal envenoming, though unlikely, cannot be excluded. Bites were expect to cause local pain, swelling, probably not necrosis, general systemic effects, and possibly flaccid paralysis.

#### 7.4 Short-term health risk:

**Low to High:** If encountered, effects of venom vary with species from mild localized swelling (e.g. *S. maurus*) to potentially lethal effects (e.g. *V. albicornuta*). See effects of venom above. Mitigation strategies included avoiding contact, proper wear of uniform (especially footwear), and timely medical treatment. Confidence in the health risk estimate is low (Reference 9, Table 3-6).

#### 7.5 Long-term health risk:

**None identified.**

## 8 Heat/Cold Stress

### 8.1 Heat

Summer (June - September) monthly mean daily maximum temperatures range from 72 °F to 125 °F with an average monthly peak temperature of 111 °F based on historical climatological data from the U.S. Air Force Combat Climatology Center, 14<sup>th</sup> Weather Squadron. The health risk of heat stress/injury based on temperatures alone is Low (< 78 °F) from December – February, Moderate (78-81.9°F) from November – March, and extremely high (≥ 88°F) from April – October. However, work intensity and clothing/equipment worn pose greater health risk of heat stress/injury than environmental factors alone (Reference 6). Managing risk of hot weather operations included monitoring work/rest periods, proper hydration, and taking individual risk factors (e.g. acclimation, weight, and physical conditioning) into consideration. Risk of heat stress/injury was reduced with preventive measures

#### 8.1.1 Short-term health risk:

**Low to High, mitigated to Low:** The risk of heat injury was reduced to low through preventive measures such as work/rest cycles, proper hydration and nutrition, and monitoring Wet Bulb Globe Temperature (WBGT). Risk of heat injury in unacclimatized or susceptible populations (older, previous history of heat injury, poor physical condition, underlying medical/health conditions), and those under operational constraints (equipment, PPE, vehicles) is High from April – October, Moderate from November – March, and Low from December – February. Confidence in the health risk estimate is low (Reference 9, Table 3-6).

#### 8.1.2 Long-term health risk:

**Low:** The long-term risk was Low. However, the risk may be greater to certain susceptible persons—those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions. Long-term health implications from heat injuries were rare but can occur, especially from more serious injuries such as heat stroke. It was possible that high heat in conjunction with various chemical exposures can increase long-term health risks, though specific scientific evidence was not conclusive. Confidence in these risk estimates was medium (Reference 9, Table 3-6).

## 8.2 Cold

Cold stress/injury can occur when temperatures fall below 60 °F. Because even on warm days there can be a significant drop in temperature after sunset by as much as 40 °F, there was a risk of cold stress/injury from October – April. The risk assessment for Non-Freezing Cold Injuries (NFCI), such as chilblain, trench foot, and hypothermia, was Low based on historical temperature and precipitation data. Frostbite was unlikely to occur because temperatures rarely drop below freezing. However, personnel may encounter significantly lower temperatures during field operations at higher altitudes. As with heat stress/injuries, cold stress/injuries were largely dependent on operational and individual factors instead of environmental factors alone.

### 8.2.1 Short-term health risk:

**Low:** The health risk of cold injury is Low. Confidence in the health risk estimate is medium.

### 8.2.2 Long-term health risk:

**Low:** The health risk of cold injury is Low. Confidence in the health risk estimate is high

## 9 Noise

### 9.1 Continuous

Preventive Medicine Base Camp assessments of Camp Taji indicate that noise control procedures were in place and being followed at the times assessments were conducted.

#### 9.1.1 Short-term and Long-term health risks:

**Low:** Short-term risk of noise injury with appropriate hearing protection use was low. Few exposed personnel (if any) were expected to have noticeable health effects during mission. Confidence in risk assessment was low (Reference 9, Table 3-6).

### 9.2 Impulse

Impulse noise was associated with weapons firing and exposures to enemy explosives (artillery, improvised explosive devices, etc). Exposure was intermittent; however exposures can be associated with temporary hearing loss and permanent hearing loss as well as other hearing or central nervous system disorders.

#### 9.2.1 Short-term and Long-term health risks:

Not evaluated. No impulse noise data were available for risk assessment.

## 10 Unique Incidents/Concerns

### 10.1 Potential environmental contamination sources

DoD personnel are exposed to various chemical, physical, ergonomic, and biological hazards in the course of performing their mission. These types of hazards depend on the mission of the unit and the operations and tasks which the personnel are required to perform to complete their mission. The health risk associated with these hazards depends on a number of elements including what materials are used, how long the exposure last, what is done to the material, the environment where the task or operation is performed, and what controls are used. The hazards can include exposures to heavy metal particulates (e.g. lead, cadmium, manganese, chromium, and iron oxide), solvents, fuels, oils, and gases (e.g. carbon monoxide, carbon dioxide, oxides of nitrogen, and oxides of sulfur). Most of these exposures occur when performing maintenance task such as painting, grinding, welding, engine repair, or movement through contaminated areas. Exposures to these occupational hazards can occur through inhalation (air), skin contact, or ingestion; however exposures through air are generally associated with the highest health risk.

### 10.2 Waste Sites/Waste Disposal

No data was available.

### 10.3 Fuel/petroleum products/industrial chemical spills

No data was available.

### 10.4 Pesticides/Pest Control

The risk of exposure to pesticide residues was considered within the framework of typical residential exposure scenarios, based on the types of equipment, techniques, and pesticide products that have been employed, such as enclosed bait stations for rodenticides, various handheld equipment for spot treatments of insecticides and herbicides, and a number of ready-to-use (RTU) methods such as aerosol cans and baits. The control of rodents required the majority of pest management inputs, with the acutely toxic rodenticides staged as solid formulation lethal baits placed in tamper-resistant bait stations indoors and outdoors throughout cantonment areas. Nuisance insects, including biting and stinging insects such as bees, wasps, and ants, also required significant pest management inputs. Use of pesticides targeting against these pests generally involved selection of compounds with low mammalian toxicity and short-term residual using pinpoint rather than broadcast application techniques. No pesticide application reports in the DoD DOEHRS or MESL data porta for Camp Taji were found from 1 September 2009 through 1 September 2011.

### 10.5 Asbestos

No data was available.

### 10.6 Lead Based Paint

No data was available.

## 10.7 Burn Pit

There were approximately 20 open burn pits located along the north boundary of Camp Taji. The burn pits were located approximately 0.2 km away from the nearest inhabited area and 3 to 5 km from the majority of the U.S. population. The burn pits have been continuously used for solid waste disposal since 2003; currently, only two or three of the burn pits were used at one time. Incinerators were added around 2008 but this did not eliminate the use of the burn pits until December 2010. In December 2011, the base transitioned control from the US Department of Defense to the US Department of State as one of several enduring sites of US personnel presence in country.

While not specific to Camp Taji, the consolidated epidemiological and environmental sampling and studies on burn pits that have been conducted as of the date of this publication have been unable to determine whether an association does or does not exist between exposures to emissions from the burn pits and long-term health effects (Reference 7). The committee's review of the literature and the data suggests that service in Iraq or Afghanistan (i.e., a broader consideration of air pollution than exposure only to burn pit emissions) may be associated with long-term health effects, particularly in susceptible (e.g., those who have asthma) or highly exposed subpopulations, such as those who worked at the burn pit. Such health effects would be due mainly to high ambient concentrations of PM from both natural and anthropogenic sources, including military sources. If that broader exposure to air pollution turns out to be relevant, potentially related health effects of concern are respiratory and cardiovascular effects and cancer. Susceptibility to the PM health effects could be exacerbated by other exposures, such as stress, smoking, local climatic conditions, and co-exposures to other chemicals that affect the same biologic or chemical processes. Individually, the chemicals measured at burn pit sites in the study were generally below concentrations of health concern for general populations in the United States. However, the possibility of exposure to mixtures of the chemicals raises the potential for health outcomes associated with cumulative exposure to combinations of the constituents of burn pit emissions and emissions from other sources.

### 10.7.1 Particulate Matter, less than 10 micrometers (PM<sub>10</sub>)

#### 10.7.1.2 Exposure Guidelines:

Short Term (24-hour) PM<sub>10</sub> (µg/m<sup>3</sup>):

- Negligible MEG = 250
- Marginal MEG = 420
- Critical MEG = 600

Long-term PM<sub>10</sub> MEG (µg/m<sup>3</sup>):

- Not defined and not available.

#### 10.7.1.3 Sample data/Notes:

A total of 91 valid PM<sub>10</sub> air samples were collected from 14 October 2009 to 29 January 2010. The range of 24-hour PM<sub>10</sub> concentrations was 38 µg/m<sup>3</sup> to 1700 µg/m<sup>3</sup> with an average concentration of 202 µg/m<sup>3</sup>.

#### 10.7.1.4 Short-term health risks:

**Low to Moderate:** The PM<sub>10</sub> average concentration (220 µg/m<sup>3</sup>) was below the short-term PM<sub>10</sub> negligible MEG of 250 µg/m<sup>3</sup> and was not considered a health hazard. However, the peak PM<sub>10</sub> concentration (1700 µg/m<sup>3</sup>) was greater than the short-term PM<sub>10</sub> critical MEG of 600 µg/m<sup>3</sup>. The short-term risk assessment for the peak PM<sub>10</sub> concentration was Moderate. Therefore, PM<sub>10</sub> was not

expected to pose a short-term health risk to personnel on typical days, but peak exposures can occur, increasing the health risk level to Moderate. Daily average risk levels show no hazard for 85%, low risk for 8%, moderate risk for 2%, and high risk for 4% of the time. Confidence in the short-term PM<sub>10</sub> health risk assessment was medium (Reference 9, Table 3-6).

Typical exposure to PM<sub>10</sub> was expected to have little or no impact on mission readiness. No specific medical action required for typical exposures. Peak exposures may result in reduced mission capability. At PM<sub>10</sub> concentrations above 600 µg/m<sup>3</sup>, personnel may experience very notable eye, nose, and throat irritation and respiratory effects. Visual acuity may be impaired, as well as overall aerobic capacity. Those with a history of asthma or cardiopulmonary disease may experience more severe symptoms. Conditions may also result in adverse, non-health related materiel/logistical impacts (Reference 9, Table 3-2).

#### 10.7.1.5 Long-term health risk:

**Not Evaluated-no available health guidelines.** The EPA has retracted its long-term NAAQS for PM<sub>10</sub> due to an inability to clearly link chronic health effects with chronic PM<sub>10</sub> exposure levels.

### 10.7.2 Particulate Matter, less than 2.5 micrometers (PM<sub>2.5</sub>)

#### 10.7.2.1 Exposure Guidelines:

Short Term (24-hour) PM<sub>2.5</sub> MEGs (µg/m<sup>3</sup>):

- Negligible MEG=65
- Marginal MEG=250
- Critical MEG=500

Long-term PM<sub>2.5</sub> MEG (µg/m<sup>3</sup>):

- Marginal MEG=65

#### 10.7.2.2 Sample data/Notes:

A total of 27 valid PM<sub>2.5</sub> air samples were collected from 23 September 2009 to 10 November 2009. The range of 24-hour PM<sub>2.5</sub> concentrations was 24 µg/m<sup>3</sup> to 287 µg/m<sup>3</sup> with an average concentration of 114 µg/m<sup>3</sup>.

#### 10.7.2.3 Short-term health risks:

**Low:** The short-term PM<sub>2.5</sub> risk assessment was Low for average and peak concentrations. A Low health risk assessment for typical and peak exposure concentrations suggests that short-term exposure to PM<sub>2.5</sub> at Camp Taji was expected to have little or no impact on mission readiness (Reference 9, Table 3-2). Daily average risk levels for PM<sub>2.5</sub> show no hazard for 30%, low risk for 60%, and moderate risk for 10% of the time. Confidence in the short-term PM<sub>2.5</sub> risk assessment was low (Reference 9, Table 3-6).

The hazard severity was negligible for average PM<sub>2.5</sub> exposures. The results predict that a few personnel may experience notable eye, nose, and throat irritation; most personnel will experience only mild effects. Pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated (Reference 9, Table 3-10).

For the highest observed PM<sub>2.5</sub> exposure, the hazard severity was marginal. During peak exposures at the marginal hazard severity level, a majority of personnel will experience notable eye, nose, and throat

irritation and some respiratory effects. Some lost duty days were expected. Significant aerobic activity will increase risk. Those with a history of asthma or cardiopulmonary disease were expected to experience increased symptoms (Reference 9, Table 3-10).

#### 10.7.2.4 Long-term health risks:

**Low:** The long-term health risk assessment was Low for average PM<sub>2.5</sub> concentration. A Low risk level suggests that no specific medical action will be required for long-term typical exposure concentrations. Confidence in the long-term PM<sub>2.5</sub> risk assessment was low (Reference 9, Table 3-6).

The hazard severity was marginal for average PM<sub>2.5</sub> exposures. The results predict that with repeated exposures above the marginal hazard severity threshold, it is plausible that development of chronic health conditions such as reduced lung function or exacerbated chronic bronchitis, chronic obstructive pulmonary disease (COPD), asthma, atherosclerosis, or other cardiopulmonary diseases could occur in generally healthy troops. Those with a history of asthma or cardiopulmonary disease were considered to be at particular risk. This guideline was an uncertain screening value - it was not a known health effects concentration (Reference 9, Table 3-10).

### 10.7.3 Airborne Metals from PM<sub>10</sub>

#### 10.7.3.1 Exposure Guidelines

No PM<sub>10</sub> airborne metal concentrations exceeded the short and long-term MEGs.

#### 10.7.3.2 Sample data/Notes:

A total of 91 air samples were collected at Camp Taji from 14 October 2009 to 29 January 2010. None of the analyzed metals in the samples were found at concentrations above the 1-year negligible MEGs.

#### 10.7.3.3 Short and long-term health risks:

**None identified based on available data.**

### 10.7.4 Volatile Organic Compounds (VOC)

#### 10.7.4.1 Exposure Guidelines

No VOC concentrations exceeded the short and long-term MEGs.

#### 10.7.4.2 Sample data/Notes:

The health risk assessment was based on average and peak concentration of 3 valid VOC air samples collected on 21 September 2009 and 25 September 2009. None of the analyzed VOC pollutants were found at concentrations above short or long-term MEGs.

#### 10.7.4.3 Short and long-term health risks:

**None identified based on the available sampling data.** No parameters exceeded 1-year Negligible MEGs.

## 10.7.5 Soil

### 10.7.5.1 Site-Specific Sources Identified

#### 10.7.5.2 Sample data/Notes:

A total of 7 valid surface soil samples were collected from 5 November 2009 through 27 June 2010, to assess OEH health risk to deployed personnel. The primary soil contamination exposure pathways were dermal contact and dust inhalation near the designated burn pit. Based on sample field data sheets this area was also used for physical training and recreation. Typical parameters analyzed for included Semi Volatile Organic Compounds (SVOCs), heavy metals, Polychlorinated biphenyls (PCBs), pesticides, herbicides. If the contaminant was known or suspected, other parameters may have been analyzed for (i.e. Total Petroleum Hydrocarbons (TPH) and Polycyclic aromatic Hydrocarbons (PAH) near fuel spills). The percent of the population exposed to soil and associated dust in the sampled areas was > 75% for 6 samples and < 10% for 1 sample. For the risk assessment, personnel are assumed to remain at this location for 6 months to 1 year.

#### 10.7.5.3 Short-term health risk:

**Not an identified source of health risk.** Currently, sampling data for soil are not evaluated for short term (acute) health risks.

#### 10.7.5.4 Long-term health risk:

**None identified based on available sample data.** No parameters exceeded 1-year Negligible MEGs.



**12 References<sup>1</sup>**

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3. Defense Occupational and Environmental Health Readiness System (referred to as the DOEHRs-EH database) at <https://doehrs-ih.csd.disa.mil/Doehrs/>. Department of Defense (DoD) Instruction 6490.03, *Deployment Health*, 2006.
4. DoDI 6055.05, Occupational and Environmental Health, 2008.
5. DoD MESL Data Portal: <https://mesl.apgea.army.mil/mesl/>. Some of the data and reports used may be classified or otherwise have some restricted distribution.
6. Goldman RF. 2001. Introduction to heat-related problems in military operations. *In: Textbook of military medicine: medical aspects of harsh environments Vol. 1*, Pandolf KB, and Burr RE (Eds.), Office of the Surgeon General, Department of the Army, Washington DC.
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9. USAPHC TG230, June 2010 Revision.
10. USACHPPM 2008 Particulate Matter Factsheet; 64-009-0708, 2008
11. Modification 11 to United States Central Command Individual Protection and Individual Unit Deployment Policy, 2 December 2011.
12. National Center for Medical Intelligence (NCMI). 2010. Defense Intelligence Report: (U) Baseline Infectious Disease Risk Assessment CENTCOM: Iraq. Defense Intelligence Agency, <https://www.intelink.gov/ncmi/index.php>.

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<sup>1</sup> NOTE. The data are currently assessed using the TG230 2010. The general method involves an initial review of the data which eliminates all chemical substances not detected above 1-yr negligible MEG. Those substances screened out are not considered acute or chronic health hazards so are not assessed further. For remaining substances, acute and chronic health effects are evaluated separately for air and water (soil is only evaluated for long term risk). This is performed by deriving separate short-term and long term population exposure level estimates (referred to as population exposure point concentrations (PEPC) that are compared to MEGs derived for similar exposure durations. If less than or equal to negligible MEG the risk is Low. If levels are higher than negligible then there is a chemical-specific toxicity and exposure evaluation by appropriate SMEs, which includes comparison to any available marginal, critical or catastrophic MEGs. For drinking water 15 L/day MEGs are used for the screening while site specific 5-15 L/day are used for more detailed assessment. For nondrinking water (such as that used for personal hygiene or cooking) the 'consumption rate' is limited to 2 L/day (similar to the EPA) which is derived by multiplying the 5 L/day MEG by a factor of 2.5. This value is used to conservatively assess non drinking uses of water.

**12 Where Do I Get More Information?**

If a provider feels that the Service member's or Veteran's current medical condition may be attributed to specific OEH exposures at this deployment location, he/she can contact the Service-specific organization below. Organizations external to DoD should contact DoD Force Health Protection and Readiness (FHP & R).

**Army Institute of Public Health** Phone: (800) 222-9698. <http://phc.amedd.army.mil/>

**Navy and Marine Corps Public Health Center (NMCPHC)** (formerly NEHC) Phone: (757) 953-0700. <http://www-nehc.med.navy.mil>

**U.S. Air Force School of Aerospace Medicine (USAFSAM)** (formerly AFIOH) Phone: (888) 232-3764. <http://www.wpafb.af.mil/afri/711hpw/usafsam.asp>

**DoD Force Health Protection and Readiness (FHP & R)** Phone: (800) 497-6261. <http://fhp.osd.mil>