Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Joint Base Balad (JBB) [AKA Balad Air Base(AB)/Logistical Support Area Anaconda (LSAA)], Iraq: 2009 to 2011 (closeout)

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) risks for Joint Base Balad (JBB), Iraq (also known as Balad Air Base and Logistical Support Area Anaconda). It presents a qualitative summary of health risks identified at these locations and their potential medical implications. The report is based on information collected from 1 October 2009 through closure to include deployment OEH surveillance 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 POEMS covers the remaining operational period for JBB (2009-2011). JBB was returned to the Iraqi Air Force in November 2011.

This assessment assumes that environmental sampling at JBB 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 October 2009 through 1 April 2011. For time periods prior to this assessment timeframe, see the JBB POEMS 2003 – 2009 document (completed in March 2010) available in the Military Environmental Surveillance Library (MESL) (https://mesl.apgea.army.mil/mesl/).

The POEMS can be useful to inform healthcare providers and others of environmental health conditions experienced by individuals deployed to JBB 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 records on a Standard Form (SF) 600 (Chronological Record of Medical Care).

SITE DESCRIPTION:

Joint Base Balad was one of the largest contingency airbases in Iraq. It was located in central Iraq, approximately 68 kilometers (km) north of Baghdad and 1.5 km from the Tigris River. It was built in the 1980s and was previously used as an air base for the Iraqi military. The airfield has two runways and was used for Air Force fighter jets, Army helicopters, and Army unmanned aerial systems. There were approximately 557 structures on JBB including barracks, administrative buildings, hospitals, clinics, dining facilities, bunkers, aircraft hangers, warehouses, maintenance facilities, a theater, a mosque, gymnasiums, swimming pools, and other buildings. The adjacent property was primarily used for agriculture. Irrigation canals fed by the Tigris River run around the northeastern and western sections of the base perimeter.

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 JBB. As indicated in the detailed sections that follow Table 2, controls that have been established to reduce health risk have been factored into this assessment. In some cases, e.g. ambient air, specific controls are noted, but not routinely available/feasible.

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

Short-term health risks & medical implications:

The following may have caused acute health effects in some personnel during deployment at JBB, Iraq:

Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}); food/waterborne diseases (bacterial diarrhea, hepatitis A, typhoid/paratyphoid fever, diarrhea-protozoal, diarrhea-cholera, brucellosis, hepatitis E); other endemic diseases (cutaneous leishmaniasis, Crimean-Congo fever, sandfly fever, tuberculosis (TB), leptospirosis, schistosomiasis, rabies, Q fever); venomous animals and insects; and heat stress. For food/waterborne diseases (e.g., bacterial diarrhea, hepatitis A, typhoid/paratyphoid fever, brucellosis, diarrhea-cholera, diarrhea-protozoal, hepatitis E), if ingesting local food and water, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (hepatitis A, typhoid/paratyphoid fever, brucellosis, hepatitis E). 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 reduced to low by proper wear of the treated uniform and application of repellent to exposed skin and bet net, 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 heat stress, risk can be greater for susceptible persons including those older than 45, of low fitness level, unacclimatized personnel or with underlying medical conditions. Risks from heat stress may have been reduced with preventive medicine controls, work-rest cycles, and mitigation. For venomous animals and insects, if encountered, effects of venom vary with species from mild localized swelling (e.g. S. maurus) to potentially lethal effects (e.g. V. albicornuta). For PM_{10}, 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. For PM_{10}, certain subgroups of the deployed forces (e.g., those with pre-existing asthma/cardio-pulmonary conditions) are at greatest risk of developing notable health effects. Although most effects from exposure to particulate matter 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 JBB. 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 may have caused chronic health effects in some personnel during deployment at JBB, Iraq:

The hazards associated with potential long-term health effects at JBB, Iraq include visceral leishmaniasis infection. Leishmaniasis is transmitted by sandflies. 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. At all contingency base camps certain individuals 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 – Joint Base Balad, Iraq [1, 2]

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
AIR			
Particulate matter less than 10 microns in diameter (PM_{10})	Short-term: Moderate, Daily levels varied; acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects were possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).	Limiting strenuous physical activities when air quality was especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: Low to None, Daily levels varied; acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects were 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 ($PM_{2.5}$)	Short-term: Low, A majority of the time mild acute (short term) health effects were 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 to None, A majority of the time mild acute (short term) health effects were 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, Small percentage of persons may be at increased risk for developing chronic conditions (particularly those more susceptible to acute (short term) effects (e.g., those with asthma/existing respiratory diseases).		Long-term: Data quantity insufficient to characterize risk.
Military Unique			
Non-ionizing Radiation	Short-term: Low		Short-term: Low
	Long-term: Low		Long-term: Low
ENDEMIC DISEASE			
Food borne/Waterborne (e.g., diarrhea-bacteriological)	Short-term: High, (Bacterial diarrhea, Hepatitis A, Typhoid fever) to Moderate (Diarrhea-cholera, Diarrhea-protozoal, Brucellosis) to Low (Hepatitis E). If ingesting local food/water, 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: Moderate, (Leishmaniasis-cutaneous and visceral, Crimean-Congo hemorrhagic fever, Sandfly fever) to Low (Sindbis, Rickettsioses, Typhus-murine, West Nile fever).	Preventive measures include proper wear of treated uniform, application of repellent to exposed skin and bed net use.	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.	Recreational swimming in surface waters not likely in this area of Iraq during this time period.	Short-term: Low to None for Leptospirosis and Schistosomiasis.
	Long-term: No data available		Long-term: No data available
Respiratory	Short-term: Low to Moderate; Moderate for tuberculosis (TB) to Low for meningococcal meningitis.	Providing adequate work and living space; medical screening, and	Short-term: Low to none

	Long-term: No data available	vaccination.	Long-term: No data available
Animal Contact	Short-term: Moderate (Rabies and Q-fever), Low (Anthrax and H5N1 avian influenza)	Prohibiting contact with, adoption, or feeding of feral animals IAW CENTCOM General Order (GO) 1B. Risks are further reduced in the event of assessed contact by prompt post-exposure rabies prophylaxis IAW the CDC's ACIP guidelines.	Short-term: Low to None
	Long-term: Low (Rabies)		Long-term: No data available
VENOMOUS ANIMAL/ INSECTS			
Snakes, scorpions, and spiders	Short-term: Low; If encountered, effects of venom vary with species from mild localized swelling (e.g., widow spider) to potentially lethal effects (e.g., Haley's Pit Viper).	Risk reduced by avoiding contact, proper wear of the uniform (especially footwear), and t timely treatment.	Short-term: Low; If encountered, effects of venom vary with species from mild localized swelling (e.g., widow spider) to potentially lethal effects (e.g., Haley's Pit Viper).
	Long-term: Not an identified source of health risk.		Long-term: No data available
HEAT/COLD STRESS			
Heat	Short-term: Low to High; High health risk of heat injury in unacclimatized personnel.	Risks from heat stress reduced with proper hydration and nutrition, work-rest cycles, and WBGT Monitoring.	Short-term: Low
	Long-term: 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, 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, 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 frostbite.		Long-term: Low; Long-term health implications from cold injuries are rare but can occur, especially from more serious injuries such as frostbite.
NOISE			
Continuous (Flightline, Power Production)	Short-term: High to Low, High risk to individuals that worked near major noise sources without proper hearing protection.	Risk reduced by the use of hearing protection and noise barriers.	Short-term: Low risk to the majority of personnel and to individuals that worked near major noise sources who use proper hearing protection.
	Long-term: High to Low, High risk to individuals that worked near major noise sources without proper hearing protection.		Long-term: Low risk to the majority of personnel and to individuals that worked near major noise sources who use proper hearing protection.
Unique Incidents/ Concerns			
Pesticides/Pest Control	Short-term: Low	See Section 10.2	Short-term: Low
	Long-term: Low		Long-term: Low

IAW: in accordance with
CDC: Centers for Disease Control and Prevention
ACIP: Advisory Committee on Immunizations Practice
WBGT: Wet Bulb Globe Temperature

[1]This Summary Table provides a qualitative estimate of population-based short- and long-term health risks associated with the occupational environment conditions at JBB. It does not represent an individual exposure profile. Actual individual exposures and health effects depend on many variables. For example, while a chemical may have been present in the environment, if a person did not inhale, ingest, or come into contact with a specific dose of the chemical for adequate duration and frequency, then there may have been no health risk. Alternatively, a person at a specific location may have experienced a unique exposure which could result in a significant individual exposure. Any such person seeking medical care should have their specific exposure documented in an SF600.

[2] This assessment is based on specific environmental sampling data and reports obtained from 1 October 2009 through 1 April 2011. Sampling locations are assumed to be representative of exposure points for the camp population but may not reflect all the fluctuations in environmental quality or capture unique exposure incidents.

[3]This Summary Table is organized by major categories of identified sources of health risk. It only lists those sub-categories specifically identified and addressed at JBB. The health risks are presented as Low, Moderate, High or Extremely High for both short- and long-term health effects. The health risk level is 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" is used when though a potential exposure is identified, and no health risks of either a specific short- and long-term health effects are determined. More detailed descriptions of OEH exposures that are evaluated but determined to pose no health risk are discussed in the following sections of this report.

[4]Health risks in this Summary Table are based on quantitative surveillance thresholds (e.g. endemic disease rates; host/vector/pathogen surveillance) or screening levels, e.g. Military Exposure Guidelines (MEGs) for chemicals. Some previous assessment reports may provide slightly inconsistent health 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 JBB, Iraq by Source

The following sections provide additional information about the OEH conditions summarized above. All risk assessments were performed using the methodology described in the US Army Public Health Command Technical Guide 230, *Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel* (USAPHC TG 230; Reference 12). All OEH risk estimates represent residual risk after accounting for preventive controls in place. Occupational exposures and exposures to endemic diseases are greatly reduced by preventive measures. For environmental exposures related to airborne dust, there are limited preventive measures available, and available measures have little efficacy in reducing exposure to ambient conditions.

2 Air

2.1 Site-Specific Sources Identified

Personnel deployed to JBB are exposed to various airborne constituents. These have been identified through monitoring and sampling efforts from 2 October 2009 to 16 July 2010. Windblown dust, industrial pollution, and sand contribute to PM exposures above health-based MEGs. There are a number of industrial activities, including manufacturing, construction, fuel storage and distribution, water and wastewater treatment, concrete and asphalt production, located on and around JBB that may contribute air contaminants. As of October 2009, open burn pits were no longer used to dispose of waste/refuse such as paper, plastic, and wood. Four waste incinerators and an installation-wide recycling plan that incorporates glass, plastics, and aluminum were used for disposal. In addition, used cooking oil and grease were transported to an off-site rendering and biodiesel production facility in an effort to mitigate U.S. contributions to local air quality.

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_{10}, which includes coarse particles with a diameter of 10 micrometers or less, and $PM_{2.5}$ which includes fine particles less than 2.5 micrometers in diameter, which can reach the deepest regions of the lungs when inhaled. Exposure to excessive PM is linked to a variety of potential health effects.

There were no air sampling data for 2011.

2.3 Particulate matter, less than10 micrometers (PM_{10})

2.3.1 Exposure Guidelines:

Short Term (24-hour) PM_{10} micrograms per cubic meter ($\mu g/m^3$):

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

Long-term PM_{10} MEG ($\mu g/m^3$):

- Not defined and not available.

2.3.2 Sample data/Notes:

A total of 50 valid PM_{10} air samples were collected from 3 March 2010 to 6 May 2010. The range of 24-hour PM_{10} concentrations was 59 $\mu g/m^3$ – 980 $\mu g/m^3$ with an average concentration of 179 $\mu g/m^3$.

2.3.3 Short-term health risks:
Moderate: The short-term PM_{10} health risk assessment was moderate based on peak PM_{10} sample concentrations, and the likelihood of exposure at these hazard severity levels. The average PM_{10} concentration was below the short-term PM_{10} negligible MEG and is not considered a health hazard. A moderate short-term health risk assessment estimate for peak PM_{10} exposure concentrations at JBB suggested possible degraded mission capabilities if hazards occurred during the mission (Reference 12, Table 3-2). Daily average health risk levels for PM_{10} show no hazard for 90%, low health risk for 5%, and high health risk for 5% of the time. Confidence in the short-term PM_{10} health risk assessment is medium (Reference 12, Table 3-6).

The hazard severity was negligible for average PM_{10} sample concentrations. The results indicate that a few personnel may experience notable mild eye, nose, or throat irritation; most personnel may experience only mild effects. Pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.

The hazard severity was critical for the highest observed PM_{10} sample concentrations. During peak exposures at the critical hazard severity level, most, if not all, personnel may have experienced very notable eye, nose and throat irritation respiratory effects. Some personnel may not be able to perform assigned duties. Some lost-duty days may be expected. Those with a history of asthma or cardiopulmonary disease may experience more severe symptoms.

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_{10} due to an inability to clearly link chronic health effects with chronic PM_{10} exposure levels.

2.4 Particulate Matter, less than 2.5 micrometers ($PM_{2.5}$)

2.4.1 Exposure Guidelines:

Short Term (24-hour) $PM_{2.5}$ ($\mu g/m^3$):
- Negligible MEG = 65
- Marginal MEG = 250
- Critical MEG = 500

Long-term (1year) $PM_{2.5}$ MEGs ($\mu g/m^3$):
- Negligible MEG = 15
- Marginal MEG = 65

2.4.2 Sample data/Notes:
A total of 93 valid $PM_{2.5}$ air samples were collected from 2 October 2009 to 16 July 2010. The range of 24-hour $PM_{2.5}$ concentrations was 27 $\mu g/m^3$ – 414 $\mu g/m^3$ with an average concentration of 64 $\mu g/m^3$.

2.4.3 Short-term health risks:
Low: The short-term $PM_{2.5}$ health risk assessment is low based on average and peak $PM_{2.5}$ sample concentrations, and the likelihood of exposure at these hazard severity levels. A low short-term health risk assessment estimate for typical and peak $PM_{2.5}$ exposure concentrations at JBB suggested the expected losses have little or no impact on accomplishing the mission. (Reference 12, Table 3-2). Daily average health risk levels for $PM_{2.5}$ show no hazard for 65%, low health risk for 32%, and

moderate health risk for 3% of the time. Confidence in the short-term $PM_{2.5}$ health risk assessment was medium (Reference 12, Table 3-6).

The hazard severity was negligible for average $PM_{2.5}$ sample concentrations. The results indicate that a few personnel may experience notable mild eye, nose, or throat irritation; most personnel will experience only mild effects. Pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.

The hazard severity was marginal for the highest observed $PM_{2.5}$ sample concentrations. During peak exposures at the marginal hazard severity level, a majority of personnel may have experienced notable eye, nose and throat irritation respiratory effects. Some personnel may not have been were not able to perform assigned duties. Some lost-duty days may be expected. Those with a history of asthma or cardiopulmonary disease may have experienced more severe symptoms.

2.4.4 Long-term health risks:
The long-term health risk assessment is low based on average $PM_{2.5}$ PEPC (64 µg/m^3) that exceeded the long-term $PM_{2.5}$ negligible hazard severity (15 µg/m^3). With repeated $PM_{2.5}$ exposures above 15 µg/m^3 it is considered possible that a small percentage of personnel may have increased risk for developing chronic conditions, such as reduced lung function or exacerbated chronic bronchitis, chronic obstructive pulmonary disease (COPD), asthma, atherosclerosis, or other cardiopulmonary diseases. Personnel with a history of asthma or cardiopulmonary disease are considered to be at particular risk. Confidence in long-term $PM_{2.5}$ risk assessment is medium (Reference 12, Table 3-6).

2.5 Airborne Metals from PM_{10}

2.5.1 Sample data/Notes:
A total of 50 valid PM_{10} airborne metal samples were collected from 3 March 2010 to 6 May 2010.

2.5.2 Short and long-term health risks:
None identified based on the available sampling data. However, the data quantity was insufficient to characterize the potential health risk of airborne metal exposure to U.S. personnel.

2.6 Volatile Organic Compounds (VOCs)

2.6.1 Sample data/Notes:
The health risk assessment was based on average and peak concentration of 53 valid VOCs air samples collected between 23 March 2010 to 6 May 2010. There were no VOCs sampling data for 2009 and 2011.

2.5.2 Short-term health risks:
Low: Methylene chloride typical PEPC was below the 14 day short-term negligible MEG of 1428 µg/m^3, but was exceeded by a single peak PEPC of 1900 µg/m^3. The short-term risk assessment for peak methylene chloride PEPC was low. Exposure to methylene chloride was expected to have little or no impact on mission readiness. No specific medical action required. Confidence in the risk assessment was low.

2.5.3 Long-term health risks:
Low: Acrolein average PEPC (2.3 µg/m^3) exceeded its long-term 1 year negligible MEG of 0.14 µg/m^3. The long-term health risk assessment was low. Exposure to acrolein was expected to have little or no impact on mission readiness. No specific medical action required. Confidence in long-term $PM_{2.5}$ risk assessment was low (Reference 12, Table 3-6).

3 Soil

3.1 Site-Specific Sources Identified

No samples were collected at JBB for soil. Short- and long-term health risks could not be evaluated.

4 Water

In order to assess the health risk to U.S. personnel from exposure to water in theater, the Army Institute of Public Health (AIPH) identified the most probable exposure pathways. These were 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 for untreated water samples were associated with source water for treatment and no exposure pathways were associated with those samples. Therefore, untreated samples were not assessed as potential health hazards. It was assumed that 100% of all U.S. personnel at JBB were directly exposed to Reverse Osmosis Water Purification Unit (ROWPU) treated or disinfected fresh bulk water, since this classification of water is 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. However, no bottled water sample data were available for this assessment.

4.2 Non-Drinking Water: ROWPU

4.2.1 Site-Specific Sources Identified

Potable water used for purposes other than drinking was produced by the Air Force Contract Augmentation Program (AFCAP) using ROWPUs to filter and disinfect source water taken from an irrigation canal fed by the Tigris River. Military ROWPUs are present but are only used for emergency backup. Raw-water testing (pre-ROWPU treatment) was performed for new water sources. Groundwater wells located throughout JBB have been certified by preventive medicine personnel and are authorized for use in conjunction with a ROWPU for water production, but they are only for backup if the water levels in the irrigation canal drop. Treated water was distributed to the dining facilities for cooking and hand washing. Additionally, treated water produced by ROWPU was used to fill all the water tanks on the installation for showers, toilets, personal hygiene, dust abatement, street cleaning, and washing of aircraft.

4.2.2 Sample data/Notes:

Thirteen samples taken in 2009 represented non-drinking water exposures. 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 expected to remain at this site for approximately 1 year. A conservative (protective) assumption is that personnel routinely consumed less than 5 L/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. There were no water sampling data for 2010-2011.

4.2.3 Short-term health risks:

None identified based on available sampling data**.** No parameters exceeded 2.5 times the 14-day, 5 L/d Negligible MEGs. However, the data quantity was insufficient to characterize the potential short-term health risk from non-drinking water exposure to U.S. personnel.

4.2.4 Long-term health risks:

The data quantity was insufficient to characterize the potential long-term health risk from non-drinking water exposure to U.S. personnel.

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 the 01 October 2009 through 01 April 2011 timeframe.

5.2 Depleted Uranium (DU)

No specific hazard sources were documented in DOEHRS or MESL data portal from 01 October 2009 through 01 April 2011.

5.3 Ionizing Radiation

Medical personnel used four Phillips C-arms units and one mini C-arm unit. Personnel had appropriate lead aprons available and were As Low As Reasonably Achievable (ALARA) trained, receive guidance and training from Radiology. Other radiation sources may have been present at JBB; however no data were available for this risk assessment.

5.4 Non-Ionizing Radiation

Medical personnel may have been exposed to hazards associated with lasers used in some surgical procedures. The operating room had a Holman Class 4 surgical laser used for surgery. Workers had appropriate laser eye protection available.

Many radio frequency radiating (RFR) sources were operated/maintained at the JBB, such as radars, vehicular radios, back pack radios, ground emplaced radios, avionics radios, wireless LAN, Satellite Communications Systems, Counter Remote Control Improvised Explosive Device Electronic Warfare Systems, and Cellular and Mobile Phones. Typically, RFR system operators and maintenance personnel were the only individuals potentially at risk from exposure to RFR that exceeds the standards. This risk was minimal if safety procedures documented in the system technical manuals were observed. The safety controls for these sources are typically addressed in the technical manuals specific to the particular system. Operator and maintenance personnel should have been aware of safety precautions associated with their RFR sources. Observance of the safety precautions precluded personnel from exposure to RFR that exceeded the Department of the Army and DoD standards.

Short-term and long-term health risks: Low, with a medium confidence level.

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. In addition, site-specific information from the MESL database was used. The modification 11 to the CENTCOM deployment health surveillance and force health protection regulation (Reference 11) lists deployment requirements, to include immunization and chemoprophylaxis, in effect during the period covered by 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.

6.1.1 Diarrheal diseases (bacteriological)

High, unmitigated; Low, mitigated: Unmitigated health risk to U.S. personnel was high year round. Mitigation strategies in place include consumption of approved food, water, and ice; handwashing; and applied food/water safety mechanisms. Diarrheal diseases (bacteriological) could be expected to temporarily incapacitate a very high percentage of personnel (potentially over 50 percent 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, these result in 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

High, unmitigated; Low, mitigated: Unmitigated health risk to U.S. personnel was high year round. Mitigation strategies in place include immunization, consumption of approved food, water, and ice; handwashing; and applied food/water safety mechanisms. U.S. Personnel did not drink untreated water, and vaccination for Hepatitis A is required for deployment into the CENTCOM Area of Responsibility (AOR). Hepatitis A typically occurs after consumption of fecally contaminated food or water or through direct fecal-oral transmission under conditions of poor hygiene and sanitation. Field conditions (including primitive sanitation, lack of hand washing) may facilitate outbreaks driven by person-to-person spread. A typical case involves 1 to 3 weeks of debilitating symptoms, sometimes initially requiring inpatient care; recovery and return to duty may require a month or more.

6.1.3 Typhoid/paratyphoid fever

High, unmitigated; Low, mitigated: Unmitigated health risk to U.S. personnel was high year round. Mitigation was in place to reduce the risk to low. U.S. Personnel did not drink untreated water, and vaccination with typhoid fever vaccination is required for deployment into the CENTCOM AOR. Risk was typically highest following spring floods. Typhoid and paratyphoid fever are acquired through the consumption of fecally contaminated food or water. The two diseases are clinically similar, and in areas where they are endemic, typhoid typically accounts for 90 percent of cases. Asymptomatic carriers are common with typhoid and contribute to sustained transmission. In countries with a mixture of primitive and modern sanitation and hygiene, outbreaks of typhoid fever can occur and may involve all age groups. A small number of cases (less than 1% per month attack rate) could occur among unvaccinated personnel consuming local food, water, or ice. With appropriate treatment, typhoid and paratyphoid fever are debilitating febrile illnesses typically requiring 1 to 7 days of supportive care, followed by return to duty.

6.1.4 Diarrhea-protozoal

Moderate, unmitigated; Low, mitigated: Unmitigated health risk to U.S. personnel was moderate year round. Risk was typically highest following spring floods. Mitigation strategies in place include consumption of approved food, water, and ice; handwashing; and applied food/water safety mechanisms. In general, *Cryptosporidium* spp., *Entamoeba histolytica*, and *Giardia lamblia* were the most common protozoal causes of diarrhea wherever sanitary conditions were significantly below U.S. standards. A small number of cases (less than 1% per month attack rate) could occur among personnel consuming local food, water, or ice. Outbreaks affecting a higher percentage of personnel were possible with *Cryptosporidium*. Symptomatic cases may vary in severity; typically mild disease demonstrating recovery and return to duty in less than 72 hours with appropriate therapy; severe cases may require 1 to 7 days of supportive care, followed by return to duty.

6.1.5 Brucellosis

Moderate, unmitigated; Low, mitigated: Unmitigated health risk to U.S. personnel was moderate year round. Mitigation strategies in place include consumption of approved food, water and ice; handwashing; universal blood/fluid-borne pathogen protection when working with animals; and applied food/water safety mechanisms. Brucellosis is a common disease in cattle, sheep, goats, swine, and some wildlife species in most developing countries. Humans contract brucellosis through consumption of contaminated dairy products (or foods made with such products) or by occupational exposures to infected animals. The health risk from direct animal contact was likely to be highest in rural areas where livestock were present. The health risk from contaminated dairy products exists countrywide, including urban areas. Rare cases (less than 0.1% per month attack rate) could occur among personnel consuming local dairy products or having direct contact with livestock. With appropriate treatment, brucellosis is a febrile illness of variable severity, potentially requiring inpatient care; convalescence is usually over 7 days even with appropriate treatment.

6.1.6 Diarrhea - cholera

Moderate, unmitigated; Low, mitigated: Unmitigated health risk to U.S. personnel was moderate year round. Mitigation was in place to reduce the risks to low. Mitigation strategies in place include consumption of approved food, water, and ice; handwashing; and applied food/water safety mechanisms. Development of symptomatic cholera requires exposure to large inoculums and typically is associated with ingestion of heavily contaminated food or water. Person-to-person spread of cholera occurs very infrequently, if at all. The majority of infections (75 percent or more, depending on biotype) among healthy adults are very mild or asymptomatic. Only a small percentage of infections are severe. Because cholera frequently causes serious public health impact, cholera cases are more likely to be reported under the International Health Regulations than other types of diarrhea. Rare cases (less than 0.1% per month attack rate) could occur among personnel consuming local food, water, or ice. Most symptomatic cases are mild, with recovery and return to duty in less than 72 hours on appropriate outpatient treatment; severe cases may require 1-7 days of supportive or inpatient care, followed by return to duty.

6.1.7 Hepatitis E

Low: Unmitigated health risk to U.S. personnel was low year round. Mitigation strategies in place include consumption of approved food, water, and ice; handwashing; and applied food/water safety mechanisms. Risk was typically highest following spring floods. Hepatitis E occurs in four major genotypes. Genotypes 1 and 2, found primarily in Africa and Asia, cause large numbers of sporadic cases, as well as large outbreaks. Fecal contamination of drinking water is the most common source of exposure for these genotypes. Large outbreaks are usually associated with particularly severe breakdowns in baseline sanitation, as often occurs during heavy rainfall which increases mixing of sewage and drinking water sources. Secondary household cases from person-to-person transmission are uncommon. Unlike hepatitis A, where local populations living in poor sanitary conditions were usually highly immune from childhood exposures, immunity levels for hepatitis E were often much lower, even in areas of extremely poor sanitation. Typically, outbreaks of hepatitis E occur primarily among adults. Although data are insufficient to assess potential disease rates, we cannot rule out rates approaching 1 percent per month among personnel consuming local food, water, or ice. Rates may exceed 1 percent per month for personnel heavily exposed during outbreaks in the local population. Typical case involves 1 to 3 weeks of debilitating symptoms, sometimes initially requiring inpatient care; recovery and return to duty may require a month or more.

6.1.8 Short-term Health Risks:

High to Low, unmitigated; Low to None, mitigated: The overall short-term unmitigated health risk associated with other foodborne and waterborne diseases at JBB was considered high (for bacterial diarrhea, hepatitis A, typhoid fever), moderate (for diarrhea-protozoal, diarrhea-cholera, brucellosis),

and low (Hepatitis E) if local food or water was consumed. Preventive Medicine measures such as vaccinations, consumption of approved food, water, and ice; and handwashing reduced the health risk to low to none. Confidence in the risk estimate was medium.

6.1.9 Long-term health risks:
None identified based on available data. Confidence in the risk estimate was medium.

6.2 Arthropod Vector-Borne Diseases

During warmer months (typically from April through November), ecological conditions support populations of arthropod vectors, including mosquitoes, ticks, and sandflies, with variable rates of disease transmission. A variety of vector-borne diseases occur at low or unknown levels; as a group, these diseases may constitute a significant risk in the absence of mitigation measures. Personnel exposed to mosquitoes, ticks, sandflies, or other biting vectors were at risk during day or night.

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-cutaneous
Moderate, unmitigated; Low, mitigated: Unmitigated health risk to U.S. personnel was moderate with seasonal transmission (April-November). Leishmaniasis-cutaneous (acute form) is transmitted by sandflies. A small number of cases (less than 1% per month attack rate) could occur among personnel exposed to sandfly bites in areas with infected people, rodents, dogs, or other reservoir animals. In groups of personnel exposed to heavily infected sandflies in focal areas, attack rates can be very high (over 50%). Mitigation strategies in place include Individual Protective Measures (IPM) practices, permethrin treated uniforms, pesticides, reduction of pest/breeding habitats, and engineering controls. Cutaneous infection is unlikely to be debilitating, though lesions can be disfiguring.

6.2.3 Leishmaniasis – visceral
Moderate, unmitigated; Low, mitigated: Unmitigated health risk to U.S. personnel was moderate with seasonal transmission (April-November). Leishmaniasis-visceral is transmitted by sandflies. Rare cases are possible among personnel exposed to sandfly bites in areas with infected humans, dogs, or other reservoir animals. Asymptomatic chronic infections may occur and may become symptomatic years later. When symptomatic, visceral leishmaniasis causes a severe febrile illness, which typically requires hospitalization with convalescence over 7 days. Mitigation strategies in place include IPM practices, permethrin treated uniforms, pesticides, reduction of pest/breeding habitats, and engineering controls.

6.2.4 Crimean-Congo hemorrhagic fever
Moderate, unmitigated; Low, mitigated: Unmitigated health risk to U.S. personnel was moderate year round. Crimean-Congo hemorrhagic fever (CCHF) infections can occur as sporadic cases or clusters of cases, and are associated with tick bites or occupational contact with blood or secretions from infected animals. Outbreaks of CCHF occur infrequently. It is a very severe illness typically requiring intensive care with fatality rates from 5% to 50%. Mitigation strategies in place include IPM practices, permethrin treated uniforms, pesticides, reduction of pest/breeding habitats, and engineering controls.

6.2.5 Sandfly fever
Moderate, unmitigated; Low, mitigated: Unmitigated health risk to U.S. personnel was moderate with seasonal transmission (May-June and September-October). The disease is transmitted by sandflies, which typically bite at night and breed in dark places rich in organic matter, particularly in rodent or other animal burrows. Rare cases are possible. Abandoned dwellings, sometimes used by

troops as temporary quarters, also can harbor significant numbers of sandflies. Although data are insufficient to assess potential disease rates, 1 to 10 percent of personnel could be affected per month under worst-case conditions with no mitigation measures in place. In small groups exposed to heavily infected sandfly populations in focal areas, attack rates can be very high (over 50 percent). Incidents can result in debilitating febrile illness typically requiring 1 to 7 days of supportive care followed by return to duty. Mitigation measures in place include IPM practices and permethrin treated uniforms. Mitigation strategies include proper wear of treated uniforms, application of repellent to exposed skin, and use of bed nets (when applicable). Additional measures used include the use of pesticides, reduction of pest/breeding habitats, and engineering controls.

6.2.6 Sindbis (and Sindbis-like viruses)
Low: Unmitigated health risk to U.S. personnel was low with seasonal transmission (April-November). 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. Mitigation measures in place include IPM practices and permethrin treated uniforms. Mitigation strategies include proper wear of treated uniforms, application of repellent to exposed skin, and use of bed nets (when applicable). Additional measures used include the use of pesticides, reduction of pest/breeding habitats, and engineering controls.

6.2.7 *Rickettsioses, tickborne (spotted fever group)*
Low: Unmitigated health risk to U.S. personnel was low with seasonal transmission (April-November). 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. Mitigation measures in place include IPM practices and permethrin treated uniforms. Mitigation strategies include proper wear of treated uniforms, application of repellent to exposed skin, and use of bed nets (when applicable). Additional measures used include the use of pesticides, reduction of pest/breeding habitats, and engineering controls.

6.2.8 *Typhus-murine (fleaborne)*
Low: Unmitigated health risk to U.S. personnel was low year round. Typhus-murine 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. Mitigation measures in place include IPM practices and permethrin treated uniforms. Mitigation strategies include proper wear of treated uniforms, application of repellent to exposed skin, and use of bed nets (when applicable). Additional measures used include the use of pesticides, reduction of pest/breeding habitats, and engineering controls.

6.2.9 West Nile fever
Low: Unmitigated health risk to U.S. personnel was low with seasonal transmission (April-November). West Nile fever was present and maintained by the bird population and mosquitoes that help to transfer the diseases from birds to humans. The majority of infections in young, healthy adults are asymptomatic although it can result in fever, headache, tiredness, and body aches, occasionally with a

skin rash (on the trunk of the body) and swollen lymph glands. West Nile fever is a febrile illness typically requiring 1-7 days of inpatient care followed by return to duty; convalescence may be prolonged. Mitigation strategies in place include IPM practices, permethrin treated uniforms, pesticides, reduction of pest/breeding habitats, and engineering controls.

6.2.10 Short -term health risks:

Moderate to Low, unmitigated; Low to None, mitigated: The overall short-term unmitigated health risk associated with arthropod vector-borne diseases at JBB was considered Moderate (for sandfly fever, leishmaniasis (cutaneous and visceral), and Crimean-Congo hemorrhagic fever) and Low (for rickettsioses, typhus-murine (fleaborne) West Nile fever, and sindbis). Preventive measures such as vaccinations, consumption of approved food, water, and ice; handwashing; and applied food/water safety reduced the health risk to low to none for arthropod vector-vector borne diseases. Confidence in the risk estimate was medium.

6.2.11 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.

6.3.1 Leptospirosis

Moderate, unmitigated; Low, mitigated: Unmitigated health risk to U.S. personnel was moderate with seasonal transmission (April-November). Human infections occur 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. Mitigation strategies in place include avoiding water contact and recreational water activities; proper wear of uniform, especially footwear, and protective coverings for cuts/abraded skin.

6.3.2 Schistosomiasis

Moderate, unmitigated; Low, mitigated: Unmitigated health risk to U.S. personnel was moderate with seasonal transmission (April-November). 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 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. Mitigation strategies in place include avoiding water contact and recreational water activities; proper wear of uniform, especially footwear, and protective coverings for cuts/abraded skin.

6.3.3 Short -term health risks:
Moderate, unmitigated; Low to None, mitigated: The overall short-term unmitigated health risk associated with water contact diseases at JBB was considered moderate (for leptospirosis and schistosomiasis). Preventive measures such as avoiding water contact and recreational water activities; and protective coverings for cuts/abraded skin reduced the health risk to low to none. Confidence in the risk estimate was medium.

6.3.4 Long -term health risks:
None identified based on available data. Confidence in the risk estimate was medium.

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.

6.4.1 Tuberculosis (TB)
Moderate, unmitigated; Low, mitigated: Unmitigated health risk to U.S. personnel was moderate year round. Tuberculosis (TB) is usually transmitted through close and prolonged exposure to an active case of pulmonary or laryngeal TB, but can also occur with incidental contact. The risk of TB in U.S. forces varies with individual exposure. TB was evaluated as part of the Post Deployment Health Assessment (PDHA). Mitigation strategies include routine medical screenings; 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 (treating active case, detainee operations); and active case isolation in negative pressure rooms, where available.

6.4.2 Meningococcal meningitis
Low: Unmitigated health risk to U.S. personnel was low year round. Meningococcal meningitis is transmitted from person to person through droplets of respiratory or throat secretions. Risk is comparable to the U.S. among unvaccinated personnel who have close contact with the local population. Close and prolonged contact facilitates the spread of this disease. Meningococcal meningitis is a potentially very severe disease typically requiring intensive care; fatalities may occur in 5-15% of cases. Mitigation strategies include routine medical screenings; enforcing minimum space allocation in housing units; implementing head-to-toe sleeping in crowded housing units; implementation of proper PPE, when necessary (treating active case, detainee operations); and active case isolation in negative pressure rooms, where available. Additional measures include vaccination and frequent sanitation of common use items (phones, door handles) and areas.

6.4.3 Short-term health risks:
Moderate to Low, unmitigated; **Low to None, mitigated:** The overall short-term unmitigated health risk associated with respiratory diseases at JBB was considered moderate (for tuberculosis) to low (for meningococcal meningitis). Preventive measures such as vaccination; routine medical screenings; and active case isolation in negative pressure rooms reduced the health risk to low to none. Confidence in the risk estimate was medium.

6.4.4 Long-term health risks:
None identified based on available data. TB was evaluated as part of the Post Deployment Health Assessment (PDHA). A TB skin test was required post-deployment if potentially exposed and was based upon individual service policies.

6.5 Animal-Contact Diseases

6.5.1 Rabies
Moderate, unmitigated; Low, mitigated: Unmitigated health risk to U.S. personnel was moderate year round. 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 U.S. 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 Q-Fever
Moderate, unmitigated; Low, mitigated: Unmitigated health risk to U.S. personnel was moderate year round. Rare cases were possible among personnel exposed to aerosols from infected animals, with clusters of cases possible in some situations. Significant outbreaks (affecting 1-50 percent) could 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. Q-Fever is a debilitating febrile illness, sometimes presenting as pneumonia, typically requiring 1 to 7 days of inpatient care followed by return to duty. Mitigation strategies include consuming approved food sources, avoidance of animals and farms, dust abatement when working in these areas (wet mop, water sprayed on high volume traffic areas, etc.), and proper PPE for personnel working with animals.

6.5.3 Anthrax
Low: Unmitigated health risk to U.S. personnel was low year round. Cutaneous and gastrointestinal anthrax are the most common forms of naturally occurring infection; cutaneous anthrax is transmitted by direct contact with infected animals or carcasses, including hides. Eating undercooked infected meat can result in contracting gastrointestinal anthrax. Pulmonary anthrax is contracted through inhalation of spores and is extremely rare. Cutaneous anthrax typically requires 1 to 7 days of supportive care with subsequent return to duty; gastrointestinal anthrax typically requires hospitalization, and has a high fatality rate if untreated. Mitigation strategies include consuming approved food sources, avoidance of animals and farms, dust abatement when working in these areas (wet mop, water sprayed on high volume traffic areas, etc.), and proper PPE for personnel working with animals, and immunization.

6.5.4 H5N1 avian influenza
Low: Unmitigated health risk to U.S. personnel was low year round. Extremely rare cases could occur in U.S. personnel who have close contact with birds or poultry infected with H5N1. H5N1 is a very severe illness. The fatality rate is higher than 50 percent in symptomatic cases. Mitigation strategies include avoidance with birds/poultry and proper cooking temperatures for poultry products.

6.5.5 Short-term health risks:
Moderate to Low, unmitigated; Low to None, mitigated: The overall short-term unmitigated health risk associated with animal contact diseases at JBB was considered moderate (for rabies, Q-fever) to Low (for anthrax, H5N1 avian influenza). Preventive measures such as consuming approved food sources; immunization; and avoidance of animals and farms reduced the health risk to low to none. Confidence in risk estimate was medium.

6.5.6 Long-term health risks:
Low: The long term risk for rabies is low because the incubation period for rabies can be several years in rare cases.

7 Venomous Animal/Insect

All information was taken directly from the Clinical Toxicology Resources web site from the University of Adelaide, Australia (Reference 3). The species listed below have home ranges that overlap the location of JBB, 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*, *Buthacus macrocentrus*, *Compsobuthus jakesi*, *Compsobuthus matthiesseni*, *Compsobuthus werneri Odontobuthus doriae*, *Orthochirus iraqus*, and *Orthochirus scrobiculosus*: Clinical effects unknown; there are a number of dangerous Buthid scorpions, but also others known to cause minimal effects only. Without clinical data it is unclear where this species fits within that spectrum.
- *Euscorpius italicus* and *Scorpio maurus*: Mild envenoming only, not likely to prove lethal.
- *Hemiscorpius lepturus*: Severe envenoming possible, potentially lethal.
- *Hottentotta saulcyi*, *Hottentotta scaber*, and *Hottentotta schach*: Moderate envenoming possible but unlikely to prove lethal.

7.3 Snakes
- *Cerastes gasperettii*: Potentially lethal envenoming, though unlikely.
- *Hemorrhois ravergieri*, *Malpolon monspessulanus*, *Psammophis schokari*, *Pseudocyclophis persicus*: Clinical effects unknown, but unlikely to cause significant envenoming.
- *Macrovipera lebetina* subspecies e*uphratica* and subspecies *obtusa,and Vipera albicornuta*: Severe envenoming possible, potentially lethal.
- *Platyceps rhodorachis* and *Psammophis lineolatus*: Mild envenoming only, not likely to prove lethal.
- *Walterinnesia aegyptia*: Clinical effects unknown, but potentially lethal envenoming, though unlikely, cannot be excluded.

7.4 Short-term health risk:
Low: If encountered, effects of venom vary with species from mild localized swelling (e.g. widow spider) to potentially lethal effects (e.g. Haley's Pit Viper). Confidence in the health risk estimate is low (Reference 12, Table 3-6).

7.5 Long-term health risk:
None identified.

8 Heat/Cold Stress

8.1 Heat

Summer: March through October generally produced temperatures from 75 °F (degrees Fahrenheit) to 125 °F (reported as high as 142 °F). Heat injuries may occur sporadically; personnel were continually educated on heat stress, water intake and work/rest cycles. Temperature extremes could increase the potential for heat related injuries, including dehydration, heat exhaustion, and heat stroke. Early symptoms included mild irritation, lethargy, and inability to concentrate. Measures were in place to mitigate more serious effects of this critical hazard. Winter: November through February generally produced temperatures from 55 °F to 95 °F.

The risk of heat stress/injury based on annual monthly average high temperatures alone was extremely high from April - October (91-115 °F). However, work intensity and clothing/equipment worn posed greater risk of heat stress/injury than environmental factors alone (Reference 8). 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. With protective measures in place the short-term risk assessment was low, except for April – October where the risk of heat stress/injury was high. Because the occurrence of heat stress/injury was strongly dependent on operational factors (work intensity and clothing), confidence in the risk estimate was low. Long-term health implications from heat injuries were rare but can occur, especially from more serious injuries such as heat stroke.

8.1.1 Short-term health risk:
High, unmitigated; Low, mitigated: The short-term health risk of heat injury was high in unacclimated personnel. Preventive measures such as work-rest cycles; and proper hydration reduced the health risk to low.

8.1.2 Long-term health risks:
Low: The long-term health 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 could occur–especially from more serious heat injuries such as heat stroke. It was possible that high heat in conjunction with various chemical exposures could increase long-term health risks, though specific scientific evidence was not conclusive. Confidence in these risk estimates was medium.

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 – May. 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 have encountered 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. With protective measures in place the risk assessment was low for short-term cold stress/injury; confidence in the risk estimate was medium. Long-term risk assessment was low for cold stress/injury; confidence in the risk estimate was high.

Short-term and Long-term health risks: The risk of cold injury was low. Confidence in this risk estimate was medium.

9 Noise

9.1 Continuous

Power generation and flight operations that took place on JBB created outdoors noise levels that occasionally fluctuated above the threshold level requiring single-level hearing protection of 85 A-weighted decibels (dBA). In addition, health effects of noise exposure as low as 80 dBA occurring the same time as exposures to certain chemicals (carbon monoxide, aircraft fuels, and industrial chemicals) could have caused permanent hearing loss. For the majority of personnel on this site, noise levels above the hearing protection threshold are for short durations and average daily exposures were below levels requiring participation in a hearing conservation program. For those individuals working on or near the flight line there may have been intermittent high level (>115 dBA) exposures from fighter aircraft run-ups/engine tests and sorties of transport and other aircraft. Individuals working or living near the flight line may have also been exposed to low level 'nuisance' noise (< 85 dBA). These continuous low level exposures may have caused sleep loss, fatigue, increase stress levels and increased blood pressure. The long term health effects due to this 'nuisance' noise were undetermined.

Preventive Medicine Quarterly Base Camp Inspection reports of JBB (2009 – 2011) concluded that noise control was not an issue at the time of the assessment, and noise control procedures were in place and being followed.

Short-term and Long-term risks: **High, unmitigated; Low, mitigated**: The unmitigated health risk was high for individuals working near major noise sources without proper hearing protection. Risk was reduced to low through use of proper hearing protection. Confidence in risk estimate was medium.

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 could be associated with temporary hearing loss and permanent hearing loss as well as other hearing or central nervous system disorders. Sound level survey of controlled detonation on 21 October 2009 showed a dBA range of 104 – 112.5.

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 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 DOEHS Data Portal for JBB were found from 1 October 2009 through 1 April 2011.

10.2.1 Short-term and Long-term health risks:
Low. Confidence in this risk estimate was low to medium.

10.3 Burn Pits

There was no burn pit activity during the time period (1 October 2009 to 1 April 2011) covered by this POEMS. No specific hazard sources were documented in the DoD DOEHRS or MESL data portal.

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 9). 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 near 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.

11 References[1]

1. Casarett and Doull's Toxicology: the Basic Science of Poisons, Chapter 2- Principles of Toxicology; Fifth Edition, McGraw Hill, New York.

2. CDC. 2012. Morbidity and Mortality Weekly Report. Imported Human Rabies in a U.S. Army Soldier. May 4, 2012. 61(17); 302-305.

3. Clinical Toxinology Resources: http://www.toxinology.com/. University of Adelaide, Australia.

4. CJCS (MCM) 0028-07, *Procedures for Deployment Health Surveillance,* 2007.

5. 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.

6. DoDI 6055.05, Occupational and Environmental Health, 2008.

7. 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.

8. 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.

9. IOM (Institute of Medicine). 2011. Long-term health consequences of exposure to burn pits in Iraq and Afghanistan. Washington, DC: The National Academies Press.

10. Joint Staff Memorandum (MCM) 0028-07, Procedures for Deployment Health Surveillance, 2007.

11. Modification 11 to United States Central Command Individual Protection and Individual Unit Deployment Policy, 2 December 2011.

12. USAPHC TG230, June 2010 Revision.

13. USACHPPM. 2008. Particulate Matter Factsheet; 64-009-0708, 2008.

[1] NOTE. The data are currently assessed using the 2010 TG230. The general method involves an initial review of the data which eliminates all chemical substances not detected above 1-yr negligible MEGs. 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 water (soil is only evaluated for long term risk). This is performed by deriving separate short-term and long term population exposure level and 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/afrl/711hpw/usafsam.asp
DoD Force Health Protection and Readiness (FHP & R) Phone: (800) 497-6261. http://fhp.osd.mil