Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Al Kut, Joint Security Station Al Ezdahar, Forward Operating Base Delta, and Logistical Staging Area Geiger, Iraq
Calendar Years: 2003 to CLOSE

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 Al Kut, Iraq and vicinity that includes Joint Security Station (JSS) Al Ezdahar, Forward Operating Base (FOB) Delta, and Logistical Staging Area (LSA) Geiger. 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 28 April 2003 through 31 August 2011 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. The information collected, and therefore the report, represents the entire duration of operations at the facilities.

This assessment assumes that environmental sampling at Al Kut and vicinity 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 28 April 2003 through 31 August 2011.

The POEMS can be useful to inform healthcare providers and others of environmental health conditions experienced by individuals deployed to Al Kut and vicinity 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:

Al Kut, also Al Kut Airfield, was the former Air Force Academy for the Iraqi Air Force. Al Kut is located approximately 115 miles southeast of Baghdad. The Tigris River forms part of the northwest perimeter of the base. The town of Al Kut is 5 miles northeast of the base.

FOB Delta was a forward operating base located at Al Kut Airfield that was formally used as a flight training base. FOB Delta, over 7,000 acres, was used to train Iraqi Soldiers and police. The base was given back to the Iraqi Air Force in 2010 and is currently used as an Iraqi Security Forces training base.

JSS Al Ezdahar was a combat patrol base (about 7 acres) located approximately 45 km from FOB Delta. JSS Al Ezdahar was located in an urban area surrounded by land primarily used for agricultural purposes.

Logistical Staging Area Geiger was located just west of Al Kut, Iraq on an abandoned Iraqi military airfield (Al Kut Airfield).

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 Al Kut and vicinity. 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 Al Kut and vicinity:

Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}); inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$); food/waterborne diseases (e.g., bacterial diarrhea, hepatitis A, typhoid fever, brucellosis, diarrhea-cholera, diarrhea-protozoal); other endemic diseases (leishmaniasis – cutaneous and visceral, Crimean-Congo hemorrhagic fever, sandfly fever, leptospirosis, schistosomiasis, Tuberculosis (TB), rabies, Q fever); heat stress; continuous noise; and waste site/disposal. For food/waterborne diseases (e.g., bacterial diarrhea, hepatitis A, typhoid fever, brucellosis, diarrhea-cholera, diarrhea-protozoal), if ingesting local food and water, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (hepatitis A, typhoid fever, 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 (leishmaniasis - cutaneous and visceral, 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, application of repellent to exposed skin and bed net, and appropriate chemoprophylaxis. For water contact diseases (leptospirosis, schistosomiasis) activities involving extensive contact with surface water increase risk. For respiratory diseases (TB), personnel in close-quarter conditions could have been at risk for person-to-person spread. 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, or with underlying medical conditions. Risks from heat stress may have been reduced with preventive medicine controls, proper hydration, work-rest cycles, and mitigation. For continuous noise exposure, the short-term risk is to personnel working near major noise sources; risk may have been reduced to personnel working near major noise sources by wearing proper hearing protection and use of noise barriers. Due to improper solid waste storage and disposal, an outbreak of disease may have been possible. Risks due to solid waste deficiencies may have been avoided or reduced with appropriate sanitation and waste management practices.

Air quality: For PM_{10} and $PM_{2.5}$, 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, particularly exposures to high levels of dust such as during high winds or dust storms. For PM_{10} and $PM_{2.5}$, 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. There were multiple burn pits at Al Kut and vicinity (refer to section 10.8). For burn pits, exposures to high levels of PM_{10} and $PM_{2.5}$ 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 particulate matter and 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 Al Kut and vicinity. Personnel who reported with symptoms or required treatment while at this site should have exposure and treatment noted in medical record (e.g., electronic medical record and/or on a Standard Form (SF) 600 (*Chronological Record of Medical Care*).

Long-term health risks & medical implications:
The following may have caused acute health effects in some personnel during deployment at Al Kut and vicinity:

For continuous noise exposure, the long-term risk is to personnel working near major noise sources. Risk may have been reduced to personnel working near major noise sources by wearing proper hearing protection and use of noise barriers.

Air quality: Fine particulate matter less than 10 micrometers in diameter (PM_{10}) was not evaluated for long –term risk due to no available health guidelines, and data was insufficient to evaluate the long-term risk of inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$). However, the area was a dusty desert environment. There were multiple burn pits at Al Kut and vicinity (refer to section 10.8). For inhalational exposure to high levels of dust and particulate matter, such as during high winds or dust storms, and for exposure to burn pit smoke, it was considered possible that some otherwise healthy personnel who were exposed for a long-term period to dust and particulate matter and burn pit smoke could have developed 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 dust and particulate matter exposures and exposures to burn pit smoke were acknowledged, 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, 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 – Al Kut and vicinity, 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 to High, 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 to High, 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: Data quantity insufficient to characterize risk.		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 (Al Kut Gastroenteritis/food poisoning, 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, 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.	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 vaccination.	Short-term: Low to none
	Long-term: No data available		Long-term: No data available

Animal Contact	Short-term: Moderate (Rabies and Q-fever), Low (Anthrax and H5N1 avian influenza) Long-term: Low (Rabies)	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: Low to None 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). Long-term: No data available	Risk reduced by avoiding contact, proper wear of the uniform (especially footwear), and 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: No data available
HEAT/COLD STRESS			
Heat	Short-term: Low to High; High health risk of heat injury in unacclimatized personnel. 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.	Risks from heat stress reduced with proper hydration and nutrition, work-rest cycles, Wet Bulb Globe Temperature (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.
Cold	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.	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.
NOISE			
Continuous (Flightline, Power Production)	Short-term: High to Low, High risk to individuals that worked near major noise sources without proper hearing protection. Long-term: High to Low, High risk to individuals that worked near major noise sources without proper hearing protection.	Hearing protection used by personnel in higher risk areas.	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: Low risk to the majority of personnel and to individuals that worked near major noise sources who use proper hearing protection.
Unique Incidents/ Concerns			
Waste Sites/Waste Disposal	Short-term: Moderate Long-term: Low	Risk due to solid waste deficiencies management may have been avoided or reduced with appropriate sanitation and waste management practices.	Short-term: Low Long-term: Low

General and Field Sanitation	Short-term: Low Long-term: Not an identified source of health risk.	Regular base camp inspections conducted by Preventive Medicine personnel mitigate the spread of disease through encouragement of improved sanitation and living conditions.	Short-term: Low Long-term: Not an identified source of health risk.
Pesticides/Pest Control	Short-term: Low Long-term: Low	See Section 10.7	Short-term: Low Long-term: Low
Burn Pits	PM_{10} Short-term: Low to High, 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). Particulate matter contributions from burn pits and environmental conditions could not be distinguished from one another. Long-term: No health guidelines	Risks reduced by limiting strenuous physical activities when air quality was especially poor; and action such as closing tent flaps, windows, and doors. Other control measures included locating burn pits downwind of prevailing winds, increased distance from troop populations, and improved waste segregation and management techniques.	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
	$PM_{2.5}$ Data quantity insufficient to characterize short and long-term health risks. Short-term health effects could include eye, nose, throat, and lung irritation. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).		Short and Long-term: Data quantity insufficient to characterize risk.

[1]This Summary Table provides a qualitative estimate of population-based short- and long-term health risks associated with the occupational environment conditions at Al Kut and vicinity. 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 28 April 2003 through 31 August 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 Al Kut and vicinity. 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 Al Kut and Vicinity, 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). 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

Al Kut is situated in a dusty semi-arid desert environment. Inhalational exposure to high levels of dust and particulate matter, such as during high winds or dust storms, may result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel. Additionally, 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. Other sources of airborne contaminants at the base camp included diesel vehicle and generator exhaust, dust from unpaved roads and surfaces, firing ranges, and aircraft exhaust. Additional exposures from the DoD use of open burn pits to dispose of waste/refuse such as paper, plastic, and wood may have also occurred. The risk assessment for air samples taken near the burn pits are presented in Section 10.8. 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_{10}, which includes coarse particles with a diameter of 10 micrometers or less, and fine particles less than 2.5 micrometers in diameter ($PM_{2.5}$), 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 the 2004-2007 and 2011 timeframe.

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 95 valid PM_{10} air samples were collected from 2003 and 2008-2010. The range of 24-hour PM_{10} concentrations was 24 µg/m^3 – 1766 µg/m^3 with an average concentration of 292 µg/m^3.

FOB Delta: A total of 91 valid PM_{10} air samples were collected from 2008 to 2010. The range of 24-hour PM_{10} concentrations was 24 µg/m^3 – 1766 µg/m^3 with an average concentration of 296 µg/m^3.

LSA Geiger: A total of four valid PM_{10} air samples were collected in 2003. The range of 24-hour PM_{10} concentrations was 109 µg/m^3 – 260µg/m^3 with an average concentration of 176 µg/m^3.

2.3.3 Short-term health risks:

Variable (Moderate to High): The short-term PM_{10} health risk assessment is Moderate to High based on average and peak PM_{10} sample concentrations, and the likelihood of exposure at these hazard severity levels. A Moderate health risk assessment is expected to have possible degraded mission capabilities if hazards occurred during the mission (Reference 9, Table 3-2). A High health risk assessment is expected to have a significant degradation of mission capabilities with the inability to accomplish all parts of the mission, or the inability to complete the mission to standard, if hazards occure during the mission (Reference 9, Table 3-2). Daily average health risk levels for PM_{10} show no hazard for 68%, low health risk for 16%, moderate health risk for 6%, and high health risk for 10% of the time. Confidence in the short-term PM_{10} health risk assessment is medium (Reference 9, Table 3-6).

The hazard severity for average PM_{10} concentrations in samples was negligible. 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 (Reference 9, Table 3-10).

For the highest observed PM_{10} sample concentration, the hazard severity was critical. 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 (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_{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) $PM_{2.5}$ (µg/m^3):

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

Long-term (1year) $PM_{2.5}$ MEGs (µg/m^3):

- Negligible MEG = 15
- Marginal MEG = 65

2.4.2 Sample data/Notes:

FOB Delta: A total of 59 valid $PM_{2.5}$ air samples were collected from 2009-2010. The range of 24-hour $PM_{2.5}$ concentrations was 20 µg/m^3 – 1343 µg/m^3 with an average concentration of 143 µg/m^3.

2.4.3 Short-term health risks:

Variable (Low to High): The short-term $PM_{2.5}$ health risk assessment is Low to High based on average and peak $PM_{2.5}$ sample 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 accomplishing the mission (Reference 9, Table 3-2). A high health risk assessment is expected to have a significant degradation of mission capabilities with the inability to accomplish all parts of the mission, or the inability to complete the mission to standard if hazards occur during the mission (Reference 9, Table 3-2). Daily average health risk levels for $PM_{2.5}$ show no hazard for 30%, low health risk for 63%, moderate health risk for 2%, and high health risk for 5% of the time. Confidence in the short-term $PM_{2.5}$ health risk assessment was medium (Reference 9, 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 (Reference 9, Table 3-10).

For the highest observed $PM_{2.5}$ exposure, the hazard severity was critical. 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 have been able to perform assigned duties. Some lost-duty days were expected. Those with a history of asthma or cardiopulmonary disease may have experienced more severe symptoms (Reference 9, Table 3-10).

2.4.4 Long-term health risks:

In 2009 and 2010, the $PM_{2.5}$ long-term marginal MEG of 65 µg/m^3 was exceeded by the average $PM_{2.5}$ concentrations (131 µg/m^3 and 174 µg/m^3 respectively). With repeated exposures above the MEG, a small percentage of personnel may have increased risk for developing chronic conditions, such as reduced lung function or exacerbated chronic bronchitis, COPD, asthma, atherosclerosis, or other cardiopulmonary diseases. Personnel with a history of asthma or cardiopulmonary disease were considered to be at particular risk. However, the data quantity was insufficient to characterize the potential long-term health risk from $PM_{2.5}$ exposure to U.S. personnel. Confidence in the risk estimate was low because of the small sample size.

2.5 Airborne Metals

2.5.1 Exposure Guidelines

Long-term (1year) Cadmium MEGs (µg/m^3):

- Negligible MEG = 0.0068

2.5.2 Sample data/Notes:

A total of 95 valid PM_{10} airborne metal samples were collected at FOB Delta and LSA Geiger from 2003, and 2008-2010.

2.5.3 Short-term health risks:

None identified based on the available sampling data.

2.5.4 Long-term health risks:

Cadmium had an average concentration (0.0071 µg/m^3) that exceeded the long-term 1-Year negligible MEG. 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)

No samples were collected at Al Kut and vicinity for VOCs in air. Short- and long-term health risks could not be evaluated.

3 Soil

3.1 Site-Specific Sources Identified

Al Kut and vicinity were surrounded mostly by undeveloped land and barren desert. The release of surface soil particles occurred when the surface was disturbed by vehicle traffic on unpaved roads, gusting winds from thunderstorms, and industrial and/or agricultural activities.

3.2 Sample data/Notes:

A total of 19 valid surface soil samples were collected from 2003-2005 and 2008-2009 to assess OEH health risk to deployed personnel. The primary soil contamination exposure pathways are dermal contact and dust inhalation. 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 3 samples and 10 > 25% for 6 samples. For the risk assessment, personnel were assumed to remain at this location for 6 months to 1 year.

3.3 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**.**

3.4 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 health risk to U.S. personnel from exposure to water in theater, the APHC 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 Al Kut and vicinity 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 indicated that ROWPU-treated and bottled water were approved sources of drinking water.

4.1 Drinking Water: Bottled or Packaged/ROWPU-Treated Water

4.1.1 Site-Specific Sources Identified

There was one bottled water brand sampled at FOB Delta. These samples included the Expeditionary Water Packaging System brand of bottled water. ROWPU-treated water used for drinking was also sampled.

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: A conservative (protective) assumption was that personnel routinely ingested 15 liters per day (L/day) of bottled water for up to 365 days (1-year). It was further assumed that control measures were not used. A total of 3 valid bottled water samples and 5 valid ROWPU-treated water samples were collected from 2003 to 2011.

4.1.3 Short-term health risk:

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

4.1.4 Long-term health risk:

The environmental health risk assessment identified chloride, chromium, magnesium, sulfate, thallium and trichloroacetic acid as having the potential to cause long-term health risks. However, long-term MEGs are not available for chloride, chromium, magnesium, sulfate, thallium and trichloroacetic acid, therefore long-term health risk associated with these chemicals could not be evaluated. Confidence in risk estimate was low.

4.2 Non-Drinking Water: Disinfected

4.2.1 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.

4.2.2 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 expected 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 13 disinfected bulk water (Non-Drinking) samples from 2003 to 2011 were evaluated for this health risk assessment.

4.2.3 Short-term health risks:

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

4.2.4 Long-term health risks:

The environmental health risk assessment identified chloride, chromium, magnesium, sulfate, and trichloroacetic acid as having the potential to cause long-term health risk. Long-term MEGs are not available for chloride, chromium, magnesium, sulfate, and trichloroacetic acid, therefore long-term health risk associated with these chemicals could not be evaluated.

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 2003 to 2011 timeframe.

5.2 Depleted Uranium (DU)

No specific hazard sources were documented in DOEHRS or MESL data portal from the 2003 through 2011 timeframe.

5.3 Ionizing Radiation

An Environmental Site Survey dated 29 July 2003 mentioned that Al Kut Airfield was the holding area for radioactive material and currently one source was being stored waiting to be moved to permanent storage. Also, an Environmental Health Site Assessment dated March 2006 mentioned potential radioactive sources at FOB Delta. This report is classified and archived on a secure network.

5.4 Non-Ionizing Radiation

There were several sources of non-ionizing radiation at FOB Al Kut and vicinity. There were multiple communication antennas and satellite dishes located throughout the camp, as well as Counter Remote Control Improvised Explosive Device (CIED) Electronic warfare (CREW) Systems in the convoy vehicles and possibly soldier backpacks. Available documentation did not identify any non-ionizing radiation related injuries.

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. 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 Al Kut Gastroenteritis/Food Poisoning

Low: A comprehensive data search found several facility inspection documents and base camp assessments from 2006, 2008 and 2009. There were no food service sanitation documents from 2003-2005, 2007, and 2010-2011. Deficiencies identified from the inspection documents and base camp assessments included:

- Temperature measuring devices not located inside refrigerators;
- Lights in refrigerators was inoperable;
- Chemical items (bleach, liquid soap) stored with food items in the connex;
- MKT area not found in a clean condition;
- Improper surface where the main dumpsters were located; and
- Matting in the food preparation area needed to be replaced.

6.1.2 Diarrheal diseases (bacteriological)

High, mitigated to Low: Diarrheal diseases are expected to temporarily incapacitate a very high percentage of personnel (potentially over 50% per month) within days if local food, water, or ice is 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.

6.1.3 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.

6.1.4 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.

6.1.5 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 occurred. 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. 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

Several site-specific reports reported feral animals (dogs, cats, foxes, jackals, and bats) on Al Kut and vicinity.

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: The short-term unmitigated risk is Moderate for rabies, and Q-fever, to Low for anthrax, and H5N1 avian influenza. Mitigation measures reduced the overall risk to Low. Confidence in risk estimate is high.

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 Toxicology Resources web site from the University of Adelaide, Australia (Reference 2). The species listed below have home ranges that overlap the location of Al Kut 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*, *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 cerastes* and *Cerastes gasperettii*: Potentially lethal envenoming, though unlikely.

- *Echis sochureki*: *M*oderate to severe, potentially lethal envenoming.

- *Hemorrhois ravergieri*, *Malpolon monspessulanus*, *Psammophis schokari*, *Pseudocyclophis persicus, Telescopus fallax* and *Telescopus tessellatus*: 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). 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

Site-specific information was not available for Al Kut. The following information is from the city of Baghdad, which is approximately 115 miles northwest of Al Kut.

8.1 Heat

Summer (June - September) monthly mean daily maximum temperatures range from 104 °F to 111 °F with an average temperature of 108 °F based on historical climatological data from the U.S. Air Force Combat Climatology Center, 14th Weather Squadron. The health risk of heat stress/injury based on temperatures alone is Low (< 78 °F) from November – March, high (82-87.9°F) in April, and extremely high (≥ 88°F) from May – 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 and Low from November – March. 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 is Low. However, the risk may be greater for 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 are rare but may occur, especially from more serious injuries such as heat stroke. It is possible that high heat in conjunction with various chemical exposures may increase long-term health risks, though specific scientific evidence is not conclusive. Confidence in these risk estimates is medium (Reference 9, Table 3-6).

8.2 Cold

8.2.1 Short-term health risks:

Winter (December - March) mean daily minimum temperatures range from 41 °F to 49 °F with an average temperature of 43 °F based on historical climatological data from the U.S. Air Force Combat

Climatology Center, 14th Weather Squadron. Because even on warm days a significant drop in temperature after sunset by as much as 40 °F can occur, there is a risk of cold stress/injury from December – March. The risk assessment for Non-Freezing Cold Injuries (NFCI), such as chilblain, trench foot, and hypothermia, is Low based on historical temperature and precipitation data. Frostbite is 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 are largely dependent on operational and individual factors instead of environmental factors alone.

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

8.1.2 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

Al Kut and vicinity had commercial and tactical generators throughout the base camps. In addition, helicopters and small cargo aircrafts contributed to noise levels.

9.1.1 Short-term and Long-term risks: **High, mitigated to Low**: 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

No specific hazard sources were documented in the DOEHRS or MESL from the 2003 to 2011 timeframe.

9.2.1 Short-term and Long-term health risks:

Not evaluated.

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

10.2.1 Hazardous and Non-hazardous Waste
JSS Ezdahar had a small burn pit located on the northeast corner of the base outside of the inner perimeter. Medical waste, to include sharps, was burned in the burn pit. Hazardous waste was transported to FOB Delta for disposal.

FOB Delta had three burn pits. The Soldier's living areas were greater than 2 miles from the burn pits. Regulated medical waste was transported to COB Adder.

A 2003 Environmental Site Survey for Al Kut listed several burn pits used by U. S. Forces to dispose of solid waste. There was also a medical waste burn pit.

Short-term and Long-term health risks: Low. Confidence in the risk estimate was medium.

10.3 Fuel/Petroleum Products/Industrial Chemical Spills

Large, dark rubber fuel bladders, steel aboveground storage tanks and underground storage tanks were located on Al Kut and vicinity. The DOEHRS and MESL databases were searched for any information on this topic. Several reports identified several POL and fuel spills throughout the base camps. However, information was not available on whether the spills were remediated.

10.3.2 *Solid Waste Management*

A review of Field Sanitation Assessments and Sanitation Inspections and Preventive Medicine Summary Reports identified several issues at FOB Delta only such as uncovered and/or overflowing solid waste receptacles; waste containers insufficient volume to contain waste; trash being burned in dumpsters; and food service dumpsters placed on a gravel surface which allowed wastes to leak into the ground surface attracting animals and/or insects.

Short-term health risk: Improper solid waste storage, uncovered and/or overflowing solid waste receptacles attracts flies, rodent, dogs and cats that could cause an outbreak of disease. An outbreak of disease can affect the mission so a moderate risk was assigned to solid waste.

Long-term health risk: Improper solid waste storage presented a low health risk.

The overall risk estimate for solid waste management was moderate.

10.4 Pesticides/Pest Control

The health risk of exposure to pesticide residues is 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. A total of 25 monthly pesticide application reports (January 2005-July 2006) and vector surveillance logs (April 2009-July 2009) in the MESL data portal for Al Kut and FOB Delta list the usage of

pesticides on the site. For each pesticide product applied during this period, the EPA approved label has been archived, providing a framework how each pesticide handled and applied (see below).

Several reports for food and general sanitation documented issues with flies, rodents, mosquitoes and possible ticks and fleas from feral animals. Personnel employed personal protective measures such as wearing permethrin-treated clothing, applying a topical insect repellent to exposed skin, and using bed nets. Pretreated uniforms were standard issue.

10.4.1 Rodenticides

Glue boards, Contrac Blox™ and traps were used to control rodents.

10.4.2 Insecticides

Insecticides used to control ants, bees, crickets, fleas, flies, lice, mosquitoes, spiders, termites, and wasps included: 565 Plus XLO™, fly sticks, Demon WP™, Demand CS™, fly baits, and Tempo SC Ultra™.

10.4.3 Herbicides

Roundup™, Glypro Plus™, and 2,4-D were used to control weeds.

10.4.4 Short-term and Long-term health risks:

Low: Long term health risk is Low. Confidence in the health risk assessment was low to medium (Reference 9, Table 3-6).

10.5 Asbestos

An Environmental Site Survey dated 29 July 2003 identified three locations (Jet Engine Test Cell, Appliance Repair Building, Boiler Room) that had friable asbestos or suspected asbestos. The report did not identify remediation, removal or disposal activities of the buildings. No specific hazards from asbestos were documented in the DOEHRS or MESL data portals from 2003 to 2011.

10.6 Lead-based Paint

No specific hazards from lead-based paint were documented in the DOEHRS or MESL data portals from 2003 through 2011.

10.7 General and Field Sanitation

Several reports and databases were assessed for waste collection/storage; latrine, shower and laundry facilities; hand washing stations; sanitary practices in barber/beauty shops and gymnasiums; living accommodations; and vector/pest problems. Over 200 base camp assessments from 2006, 2008, and 2009 characterized overall sanitation conditions at Al Kut and vicinity. There were no base camp assessments for 2002-2005, 2007, and 2010-2011.

Sanitation concerns at Al Kut and vicinity included: standing water on floors in shower trailers; stray animals; excessive trash on ground; dumpster lids continuously left open; Soldiers had less than the recommended 55 sq. ft. of living spaces inside of tent sleeping areas; regulatory field sanitation team requirements were not met; and no sanitizing solutions or paper towels were provided to wipe down gym equipment after use.

Short-term health risk:

Low: The short-term unmitigated health risk associated with general and field sanitation was considered low. Preventive measures such as trash disposal education; Soldiers policing up after themselves; disinfecting gym equipment; pop-up sleeping nets; and removing stray animals reduced the health risk.

Long-term health risk:

None identified.

10.8 Burn Pits

While not specific to Al Kut and vicinity, 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 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.

JSS Ezdahar had a small burn pit located on the northeast corner of the base outside of the inner perimeter. Medical waste, to include sharps, was burned in the burn pit.

FOB Delta had three burn pits. The Soldier's living areas were greater than 2 miles from the burn pits.

A 2003 Environmental Site Survey for Al Kut listed several burn pits used by U. S. Forces to dispose of solid waste. There was also a medical waste burn pit.

10.8.1 Particulate matter, less than 10 micrometers (PM_{10})

10.8.2 Exposure Guidelines:

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

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

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

- Not defined and not available.

10.8.2.1 Sample data/Notes:

A total of 39 valid PM_{10} air samples were collected from 2008-2009. The range of 24-hour PM_{10} concentrations was 41 $\mu g/m^3$ – 1093 $\mu g/m^3$ with an average concentration of 335 $\mu g/m^3$.

10.8.2.2 Short-term health risks:

Variable (Low to High): The short-term PM_{10} health risk assessment was low based on average PM_{10} sample concentrations and high based on peak PM_{10} sample concentrations, and the likelihood of exposure at these hazard severity levels. A low health risk assessment for average PM_{10} exposure concentrations suggestes expected losses have little or no impact on accomplishing the mission. A high health risk assessment for peak PM_{10} exposure concentrations suggestes a significant degradation of mission capabilities with the inability to accomplish all parts of the mission, or the inability to complete the mission to standard if hazards occur during the mission (Reference 9, Table 3-6).

The hazard severity was negligible for average PM_{10} sample exposures. 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 (Reference 9, Table 3-10).

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 experienced very notable eye, nose and throat irritation respiratory effects. Some personnel were not able to perform assigned duties. Some lost-duty days were expected. Those with a history of asthma or cardiopulmonary disease experienced more severe symptoms (Reference 9, Table 3-10).

10.8.2.3 Long-term health risk:

Not Evaluated-no available health guidelines. The EPA has retracted its long-term NAAQS for PM_{10} due to an inability to clearly link chronic health effects with chronic PM_{10} exposure levels.

10.8.3 Particulate matter, less than 2.5 micrometers ($PM_{2.5}$)

10.8.3.1 Exposure Guidelines:

Short Term (24-hour) $PM_{2.5}$ ($\mu g/m^3$):

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

Long-term $PM_{2.5}$ MEG ($\mu g/m^3$):

- Negligible MEG = 15
- Marginal MEG = 65

10.8.3.2 Sample data/Notes:

A total of 13 valid $PM_{2.5}$ air samples were collected from 2009-2010. The range of 24-hour $PM_{2.5}$ concentrations was 43 $\mu g/m^3$ – 687 $\mu g/m^3$ with an average concentration of 180 $\mu g/m^3$.

10.8.3.3

Short-term and long-term health risks: Not enough data to evaluate short- and long-term health risk.

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

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.

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

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

9. USA PHC 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.

[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