

Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Forward Operating Base Normandy and Joint Combat Outpost Milledge, Iraq:
2003 to 2009 (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 DoD assessment of Occupational and Environmental Health (OEH) risk for FOB Normandy, Iraq and vicinity that includes Joint Combat Outpost (JCOP) Milledge. 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 24 September 2003 through its closure sometime before December 2011, to include deployment OEHS sampling and monitoring data (e.g. air, water, and soil), field investigation and health assessment reports, as well as country and area-specific information on endemic diseases.

This assessment assumes that environmental sampling at FOB Normandy 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 24 September 2003 through 10 October 2009.

The POEMS can be useful to inform healthcare providers and others of environmental conditions experienced by individuals deployed to FOB Normandy 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: FOB Normandy and JCOP Milledge were located in the Diyala governorate (province) of east central Iraq approximately 50 miles northeast of Baghdad outside the agricultural town of Muqadiyah. The bases were buffered by the Hamrin Mountains to the east and the Diyala River to the north and west. Soldiers on Normandy were housed in old masonry-constructed barracks, many built by the British in the early 1950s. The base was in use since 2003. During its use, approximately 700 soldiers were stationed there at any given time. It was returned back to the Iraq government in 2009.

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

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 FOB Normandy and JCOP Milledge, Iraq:

Inhalable coarse particulate matter less than 10 micrometers in diameter (PM₁₀); 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; and continuous noise. 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, work-rest cycles, and mitigation. For continuous noise, there is high risk to individuals working near major noise sources (e.g., flightline, power production) without proper hearing protection; risks may have been reduced by use of appropriate hearing protection and noise barriers.

Air quality: For PM₁₀ 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 PM₁₀ 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 was a burn pit on site at JCOP Milledge. For burn pits, exposures to high levels of PM₁₀ 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 FOB Normandy and JCOP Milledge. 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 hazards associated with potential long-term health effects at FOB Normandy and JCOP Milledge, Iraq included continuous noise. For continuous noise, there is high risk of long-term effects to individuals working near major noise sources (e.g., flight line, power production) without proper hearing protection; risks may have been reduced by use of appropriate hearing protection and noise barriers.

Air quality: Although fine particulate matter less than 10 micrometers in diameter (PM₁₀) was not evaluated for long-term risk due to no available health guidelines, and data quantity was insufficient to characterize long-term risk for inhalable fine particulate matter less than 2.5 micrometers in diameter (PM_{2.5}), the area was a dusty desert environment. In addition, though there were not enough samples from the burn pit vicinity available for long-term assessment, there was a burn pit present on site at JCOP Milledge. For inhalational exposure to high levels of dust and PM_{2.5}, such as during high winds or dust storms, and for exposure to burn pit smoke, it is considered possible that some otherwise healthy personnel who were exposed for a long-term period to dust and particulate matter could develop certain health conditions (e.g., reduced lung function, cardiopulmonary disease). Personnel with a history of asthma or cardiopulmonary disease could potentially be more likely to develop such chronic health conditions. While the 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 – FOB Normandy 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			
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).	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, Daily levels vary acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).
	Long-term: No health guidelines		Long-term: No health guidelines
PM _{2.5}	Short-term: Low, A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated. However, data quantity insufficient to characterize risk.	Limiting strenuous physical activities when air quality is especially poor; and action such as closing tent flaps, windows, and doors.	Short-term: Low, A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.
	Long-term: 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 to none
	Long-term: Low		Long-term: Low to none
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: Not an identified source of health risk.		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 Leptospirosis and Schistosomiasis.
	Long-term: No data available		Long-term: No data available
Respiratory	Short-term: Moderate [Tuberculosis (TB)] and Low (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)	Prohibiting contact with, adoption, or feeding of feral animals IAW CENTCOM General Order 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. Haly's Pit Viper).	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. Haly's Pit Viper).
	Long-term: Not an identified source of health risk.		Long-term: No data available
HEAT/COLD STRESS			
Heat	Short-term: Moderate to High; Risk of heat injury in unacclimatized personnel was Moderate for April, and High from May – October.	Risks from heat stress reduced with proper hydration and nutrition, work-rest cycles, and WBGT Monitoring.	Short-term: Low
	Long-term: Low, However, the 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: 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	Risks from cold stress reduced with protective measures such as use of the buddy system, limiting exposure during cold weather, proper wear of issued protective clothing, and proper nutrition and hydration.	Short-term: Low risk of cold stress/injury.
	Long-term: Low, Long-term health implications from cold injuries were rare but could occur, especially from more serious injuries such as frostbite.		Long-term: Low; Long-term health implications from cold injuries were rare but could occur, especially from more serious injuries such as frostbite.
NOISE			

Continuous (Flightline, Power Production)	Short-term: High to Low, High risk to individuals working near major noise sources without proper hearing protection.	Risks reduced by the use of hearing protection and noise barriers.	Short-term: Low risk to the majority of personnel and to individuals working near major noise sources who use proper hearing protection.
	Long-term: High to Low, High risk to individuals working near major noise sources without proper hearing protection.		Long-term: Low risk to the majority of personnel and to individuals working near major noise sources who use proper hearing protection.
Unique Incidents/Concerns			
Pesticides/Pest Control	Short-term: Low		Short-term: Low health risk from pesticide exposure.
	Long-term: Low		Long-term: Low health risk from pesticide exposure.
Burn Pits	JCOP Milledge had a burn pit. Not enough samples were collected near the burn pit to evaluate short-and long-term health risk. 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).	Risks reduced by limiting strenuous physical activities when air quality is especially poor; and action such as closing tent flaps, windows, and doors. Other control measures include locating burn pits downwind of prevailing winds, increased distance from troop populations, and improved waste segregation and management techniques.	Short-and Long-term: Data quantity insufficient to characterize risk.

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 general ambient and occupational environment conditions at FOB Normandy and vicinity. It does not represent a unique individual exposure profile. Actual individual exposures and health effects depend on many variables. For example, while a chemical may be present in the environment, if a person does not inhale, ingest, or contact a specific dose of the chemical for adequate duration and frequency, then there may be no health risk. Alternatively, a person at a specific location may experience a unique exposure which could result in a significant individual exposure. Any such person seeking medical care should have their specific exposure documented in an SF600.

² This assessment is based on specific data and reports obtained from the September 2003 through December 2009 timeframe. It is considered a current representation of general site conditions but may not reflect certain fluctuations or unique exposure incidents. Acute health risk estimates are generally consistent with field-observed health effects.

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 FOB Normandy 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 an exposure was identified, no health risk of either a specific short- or long-term health effects were determined. More detailed descriptions of OEH exposures that were evaluated but determined to pose no health risk are discussed in the following sections of this report.

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 FOB Normandy and vicinity, Iraq by Source

The following sections describe the major source categories of potential health risk that were evaluated at FOB Normandy and vicinity, Iraq. For each category, the evaluation process includes identifying what, if any, specific sub-categories/health concerns are present. This initial step results in “screening out” certain health concerns that pose no identifiable health risk (for example if all data is below screening levels). While these sections may include sub-categories that have been determined to present no identifiable health risk, the summary table on the previous page only contains those sub-categories that were determined to pose some level of potential health risk.

2 Air

2.1 Site-Specific Sources Identified

Personnel deployed to FOB Normandy and vicinity were exposed to various airborne contaminants as identified by monitoring and sampling efforts between 24 September 2003 and 12 October 2009. Sources of airborne contaminants at the base camp included diesel vehicle and generator exhaust, dust from unpaved road and surfaces, firing ranges, aircraft exhaust, incinerators, and burn pits. In addition, dust storms, periods of high winds, and vehicle traffic passing through moon dust (very fine silts with the consistency of talcum powder) contributed to particulate matter (PM) exposures above health-based MEGs at FOB Normandy.

There were no sampling data for 2004-2007.

2.2 Particulate Matter, less than 10 microns (PM₁₀)

2.2.1 Sample data/Notes:

Exposure Guidelines:

Short Term (24-hour) PM₁₀ micrograms per cubic meter (µg/m³):

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

Long-term PM₁₀ MEG (µg/m³):

- Not defined and not available.

A total of 18 valid PM₁₀ air samples were collected from 2003, and 2008-2009. The range of 24-hour PM₁₀ concentrations was 70 µg/m³ – 941 µg/m³ with an average concentration of 435 µg/m³.

FOB Normandy: Sixteen valid PM₁₀ air samples were collected from 24 September 2003 to 11 March 2009. The range of 24-hour PM₁₀ concentrations was 70 µg/m³ – 942 µg/m³ with an average concentration of 439 µg/m³.

JCOP Milledge: Two valid PM₁₀ air samples were collected from 25 February 2009 and 15 March 2009. The range of 24-hour PM₁₀ concentrations was 102 µg/m³ – 708 µg/m³ with an average concentration of 405 µg/m³.

2.2.2 Short-term health risk:

Variable (Low to High): The short-term PM₁₀ health risk assessment estimate was low to high based on typical and peak PM₁₀ concentrations, and the likelihood of exposure at these hazard severity levels. A low short-term health risk assessment estimate for typical PM₁₀ exposure concentrations at FOB Normandy and vicinity suggested the expected losses have little or no impact on accomplishing

the mission. A high health risk assessment estimate for peak PM₁₀ exposure concentrations suggested 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 (TG 230 Table 3-2).

The hazard severity was negligible for average PM₁₀ sample concentrations. The results suggested 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 PM₁₀ 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.

However, the data quantity was insufficient to characterize the potential short-term health risk from PM₁₀ exposure to U.S. personnel. Confidence in the short-term peak PM₁₀ risk assessment is low (Reference 16, Table 3-6).

2.2.3 Long-term health risk:

Not evaluated because there are no available health guidelines. The EPA retracted its long-term National Ambient Air Quality Standard (NAAQS) for PM₁₀ due to an inability to link chronic health effects with chronic PM₁₀ exposure levels.

2.3 Particulate Matter, less than 2.5 microns (PM_{2.5})

2.3.1 Sample data/Notes:

Exposure Guidelines:

Short Term (24-hour) PM_{2.5} (µg/m³):

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

Long-term (1 year) PM_{2.5} MEGs (µg/m³):

- Negligible MEG = 15
- Marginal MEG = 65

There were no sampling data for 2003-2008.

Ten valid PM_{2.5} air samples were collected in 2009 from FOB Normandy only. The range of 24-hour PM_{2.5} concentrations was 38 µg/m³ to 243 µg/m³ with an average concentration of 110 µg/m³.

2.3.2 Short-term health risk

Low: The average and peak PM_{2.5} concentrations (110 µg/m³ and 243 µg/m³, respectively) were above the short-term PM_{2.5} negligible MEG of 65 µg/m³. The short-term risk assessment for both typical and peak PM_{2.5} concentrations was low. A low health risk assessment for typical exposure concentrations suggests that short-term exposure to PM_{2.5} was expected to have little or no impact on accomplishing the mission. Daily average risk levels for PM_{2.5} show no hazard for 22% and low risk for 78% of the time. Confidence in short-term PM_{2.5} risk assessment is Low (Reference 16, Table 3-6).

The hazard severity was negligible for average and peak PM_{2.5} exposures. The results indicated that a few personnel may have experienced notable eye, nose, and throat irritation; most personnel will

experience only mild effects. Pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may have been exacerbated. However, the data quantity was insufficient to characterize the potential short-term health risk from PM_{2.5} exposure to U.S. personnel.

2.3.3 Long-term health risk

Moderate: In 2009, the PM_{2.5} long-term marginal MEG of 65 µg/m³ was exceeded by the average PM_{2.5} concentration (110 µg/m³). With repeated exposures above the MEG, a small percentage of personnel may have increased risk for developing chronic health 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 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.

2.4 Airborne Metals from PM₁₀

2.4.1 Sample data/Notes:

A total of 18 valid PM₁₀ airborne metal samples were collected at FOB Normandy and vicinity from 2003, and 2008-2009.

2.4.2 Short-term health risks:

None identified based on the available sampling data.

2.4.3 Long-term health risks:

None identified based on the available sampling data.

2.5 Volatile Organic Compounds (VOCs)

The likely sources of VOCs on FOB Normandy and vicinity were the result of fuel storage and transfers between storage tanks, vehicles and aircraft.

2.5.1 Sample data/Notes:

The health risk assessment was based on average and peak concentrations of 22 valid volatile organic chemical (VOC) air samples collected at FOB Normandy (six samples) and JCOP Milledge (16 samples). None of the analyzed VOC pollutants were found at concentrations above short or long-term MEGs.

2.5.2 Short-term health risk:

None identified based on available sampling data.

2.5.3 Long-term health risks:

The data quantity was insufficient to characterize the potential long-term health risk from VOCs exposure to U.S. personnel. The environmental health risk assessment identified 4-Isopropyltoluene, decane, methylcyclopentane, n-Propylbenzene and sec-Butylbenzene as having the potential to cause long-term health risks. However, long-term MEGs are not available for 4-Isopropyltoluene, decane, methylcyclopentane, n-Propylbenzene and sec-Butylbenzene, therefore long-term health risk associated with these chemicals could not be evaluated. Confidence in risk estimate was low.

3 Soil

3.1 Site-Specific Sources Identified

FOB Normandy and vicinity were surrounded by mountains and the Diyata River. Soil release occurred when the surface was disturbed by vehicle traffic on unpaved roads, gusting winds from pressure systems, and industrial and/or agricultural activities.

3.1.1 *Sample data/Notes:*

Analytical data for 20 soil samples collected in 2008-2009 at FOB Normandy (11 samples), and JCOP Milledge (nine samples) were assessed for metals, inorganic and organic chemicals. There were no sampling data for 2003-2007. The percent of the population exposed to soil and associated dust in the sampled areas was > 75% for 14 samples, 50-75% for three samples, and 25-50% for three samples. For the risk assessment, personnel were assumed to remain at this location for approximately 1 year. No health hazards were identified from surface soil samples collected.

3.1.2 *Short-term health risk:*

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

3.1.3 *Long-term health risks:*

No parameters exceeded 1-year Negligible MEGs, based on mean values; however, the peak concentration of naphthalene (63 mg/kg) at JCOP Milledge was above its Negligible MEG (18 mg/kg). The sample was collected at the site of a fuel spill. However, the data quantity was insufficient to characterize the potential long-term health risk from soil exposure to U.S. personnel.

4 **Water**

In order to assess the risk to U.S. personnel from exposure to water in theater, the Army Institute of Public Health (AIPH) identified the most probable exposure pathways based on available information. The water exposures considered were the ingestion of water used for drinking and the use of water for non-drinking purposes (such as personal hygiene, or showering).

4.1 **Drinking Water**

4.1.1 *Site-Specific Sources Identified*

The primary source of drinking water at FOB Normandy and vicinity was bottled water. The secondary source of drinking water at FOB Normandy and vicinity was ROWPU-treated water from the Diyala River and several wells located on the bases. The water was treated by ROWPUs operated by KBR® (KBR® is a registered trademark of KBR inc.) to meet potable standards. There were no bottled water sampling results archived to use to conduct a risk assessment.

4.1.2 *Sample data/Notes*

Eight samples taken in 2008-2009 represented drinking water exposures at FOB Normandy only. There were no drinking water samples for the other base camp.

4.1.3 *Short-term health risk*

In 2008, magnesium exceeded its 14-day 15L/d Negligible MEG for short-term health risk. One magnesium sample (34 mg/L) exceeded its MEG (30 mg/L). TB MED 577 notes that the health effects for drinking water with a high concentration of magnesium are an increased risk of laxative effects and an increased susceptibility to dehydration because of the increased risk of laxative effects. However, the data quantity was insufficient to characterize the potential short-term health risk from drinking water exposure to U.S. personnel.

4.1.4 Long-term health risk:

The data quantity was insufficient to characterize the potential long-term health risk from drinking water exposure to U.S. personnel. The environmental health risk assessment identified chloride, chromium, magnesium, and sulfate as potential long-term health risks. However, long-term MEGs are not available for chloride, chromium, magnesium, and sulfate therefore long-term health risk associated with these chemicals could not be evaluated.

4.2 Water: Used for Other Purposes (Personal Hygiene, Showering, etc.)

4.2.1 Site-Specific Sources Identified

U.S. personnel used the ROWPU-treated water supply and well water at FOB Normandy and vicinity for non-drinking purposes (i.e., personal hygiene, and showering, etc.).

4.2.2 Sample data/Notes

Fourteen samples taken in 2008-2009 represented non-drinking water exposures at FOB Normandy (12 samples) and JCOP Milledge (two samples).

4.2.3 Short-term health risk:

None identified based on available sampling data. No parameters exceeded 2.5 times the 14-day, 5 L/d Negligible MEGs.

4.2.4 Long-term health risk:

The data quantity was insufficient to characterize the potential long-term health risk from non-drinking water exposure to U.S. personnel. The environmental health risk assessment identified chloride, chromium, magnesium, sulfate, and thallium as potential long-term health risk. Long-term MEGs are not available for chloride, chromium, magnesium, sulfate, and thallium, therefore long-term health risk associated with these chemicals could not be evaluated. Confidence in risk estimate is low.

5 Military Unique

5.1 Chemical Biological, Radiological Nuclear (CBRN) Weapons:

No specific hazard sources were documented in Defense Occupational and Environmental Health Readiness System (DOEHRS), or the Military Exposure Surveillance Library (MESL) data portal from 2003 through 2009 timeframe.

5.2 Depleted Uranium (DU):

No specific hazard sources were documented in DOEHRS or MESL data portal from 2003 through 2009.

5.3 Ionizing Radiation:

No specific hazard sources were documented in DOEHRS or MESL data portal from 2003 through 2009.

5.4 Non-Ionizing Radiation:

There were several sources of non-ionizing radiation at FOB Normandy 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 Disease¹

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 15) 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.

¹ NOTE: "Risk" level refers to both severity of disease (without controls, for example vaccinations) and probability of disease based on local rates/endemic status. Diseases described are those presenting greater risk when compared with U.S. conditions. Most identified disease risks can and are being mitigated with military preventive medicine measures/policies.

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; hand washing; 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 FOB Normandy and vicinity 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 *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 Individual Protective Measures (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.

6.2.3 *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 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.

6.2.4 *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.

6.2.5 *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.

6.2.6 *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.

6.2.7 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.

6.2.8 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.

6.2.9 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 fleabites. 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.

6.2.10 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.

6.2.11 *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 FOB Normandy and vicinity 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 IPM practices, proper wear of treated uniforms and application of repellent to exposed skin reduced the health risk to low to none for arthropod vector-vector borne diseases. Confidence in the risk estimate was medium.

6.2.12 *Long-term health risks:*

Low: The unmitigated risk is moderate for leishmaniasis-visceral (chronic). Risk was 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 FOB Normandy and vicinity 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 FOB Normandy and vicinity 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: Potential 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, and immunization.

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 FOB Normandy and vicinity 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 Toxinology Resources web site from the University of Adelaide, Australia (Reference 2). The species listed below have home ranges that overlap the location of FOB Normandy 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 wernerii*, *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.
- *Euscorpis 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*: Moderate to severe, potentially lethal envenoming.
- *Hemorrhoids ravergerii*, *Malpolon monspessulanus*, *Psammophis schokari*, *Pseudocyclophis persicus*, *Telescopus fallax* and *Telescopus tessellatus*: Clinical effects unknown, but unlikely to cause significant envenoming.
- *Macrovipera lebetina* subspecies *euphratica* 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 16, Table 3-6).

7.5 Long-term health risk:

None identified.

8 Heat/Cold Stress

Average temperatures in Iraq range from higher than 118.4 degrees Fahrenheit (°F) in July and August to below freezing in January based on historical climatological data from the U.S. Air Force Combat Climatology Center, 14th Weather Squadron (Reference 13). Most of the rainfall occurs from December through April and averages between 100 and 180 millimeters (3.9 and 7.1 inches) annually. The mountainous region of northern Iraq receives appreciably more precipitation than the central or southern desert region. Roughly 90% of the annual rainfall occurs between November and April, most of it in the winter months from December through March. The remaining six months, particularly the hottest ones of June, July, and August, are dry.

The summer months are marked by two kinds of wind phenomena. The southern and southeasterly *sharqi*, a dry, dusty wind with occasional gusts of 80 kilometers per hour (50 miles per hour), occurs from April to early June and again from late September through November. It may last for a day at the beginning and end of the season but for several days at other times. This wind is often accompanied by violent dust storms that may rise to heights of several thousand meters and close airports for brief periods. From mid-June to mid-September the prevailing wind, called the shamal, is from the north and northwest. It is a steady wind, absent only occasionally during this period. The very dry air brought by this shamal permits intensive sun heating of the land surface, but the breeze has some cooling effect.

8.1 Heat

Summer (June - September) temperatures in the FOB Normandy area ranged from 95°F to 104°F with an average temperature of 100°F. The health risk of heat stress/injury based on temperatures alone is Low (< 78°F) from November – March, Moderate (78-81.9°F) in April, high (82-87.9°F) in October, and extremely high (≥ 88°F) from May – September. However, work intensity and clothing/equipment worn pose greater health risk of heat stress/injury than environmental factors alone (Reference 6).

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

Winter (December – March) temperatures in the FOB Normandy area ranged from 55°F to 67°F with an average temperature of 60 °F. Cold stress/injury can occur when temperatures fall below 60°F. Because even on warm days a significant drop in temperature after sunset by as much as 40°F may have occurred, there was a risk of cold stress/injury from December – February. 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.

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:

FOB Normandy and vicinity had commercial and tactical generators throughout the FOB. In addition, helicopters and small cargo aircrafts contributed to noise levels.

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:

No specific hazard sources were documented in DOEHS or MESL data portals from 2003 through 2009.

10 Other Unique Occupational Hazards

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 exposures 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 health 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, vertebrate pesticides, 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, 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 two monthly pesticide application reports in the MESL data portal for FOB Normandy (May and September 2004) list the usage of pesticides on the site. For each pesticide product applied during this period, the USEPA approved label has been archived, providing a framework how each pesticide handled and applied (see below).

10.2.1 Insecticides

Insecticides used to control ants, bed bugs, bees, flies, miscellaneous insects, mosquitoes, silver fish, scorpions, and spiders included: Malathion and Piperonyl Butoxide.

10.2.3 Short-term and Long-term health risks

Low: Confidence in this health risk estimate was low (Reference 16, Table 3-6).

10.3 Lead-based Paint

No specific hazards from lead-based paint were documented in DOEHS or MESL data portals from 2003 through 2009.

10.4 Asbestos

No specific hazards from lead-based paint were documented in DOEHS or MESL data portals from 2003 through 2009.

10.5 Burn Pits

JCOP Milledge had a burn pit.

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 at burn pit sites in the study were generally below concentrations of health concern for general populations in the United States. However, the possibility of exposure to mixtures of the chemicals raises the potential for health outcomes associated with cumulative exposure to combinations of the constituents of burn pit

emissions and emissions from other sources.

One valid PM₁₀ air sample was collected from the vicinity of the JCOP Milledge burn pit on 25 February 2009. The concentration, 102 µg/m³, was above the short-term PM₁₀ negligible MEG. There are no long-term PM₁₀ MEGs. However, the data quantity was insufficient to characterize short-and long-term health risk associated with PM₁₀ exposure.

11 References²

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2. Clinical Toxicology Resources: <http://www.toxinology.com/>. University of Adelaide, Australia.
3. Defense Occupational and Environmental Health Readiness System (referred to as the DOEHS-EH database) at <https://doehrs-ih.csd.disa.mil/Doehrs/>.
4. Department of Army (DA) Technical Bulletin, Medical 577, *Sanitary Control and Surveillance of Field Water Supplies*, 2010.
5. DoDI 6055.05, Occupational and Environmental Health, 2008.
6. DoDI 6490.03, *Deployment Health*, 2006.
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 R.F. 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. Klaassen, Curtis D. *Casarett and Doull's Toxicology: the Basic Science of Poisons*, Chapter 2- Principles of Toxicology; Fifth Edition, McGraw-Hill, New York.

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

11. TB MED 530, Occupational and Environmental Health Food Sanitation, 30 Oct 2002.
12. TB MED 577, Sanitary Control and Surveillance of Field Water Supplies, 1 May 2010.
13. U.S. Air Force Combat Climatology Center. 14th Weather Squadron.
<https://notus2.afccc.af.mil/SCISPublic/>. Accessed September 2012.
14. USACHPPM, Particulate Matter Factsheet No. 64-009-0708, 2008.
15. U.S. Central Command (CENTCOM) Regulation 220-1, Deployment Health Surveillance and Force Health Protection, 2010.
16. USAPHC TG230, June 2010 Revision, Final Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel TG230.

12 Where Do I Get More Information?

<p>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).</p>
<p>U.S. Army Public Health Command (USAPHC) [(formerly the US Army Center for Health Promotion and Preventive Medicine (USACHPPM))] Phone: (800) 222-9698. http://phc.amedd.army.mil</p>
<p>Navy and Marine Corps Public Health Center (NMCPHC) (formerly NEHC) Phone: (757) 953-0700. www.nmcpHC.med.navy.mil</p>
<p>U.S. Air Force School of Aerospace Medicine (USAFSAM) (formerly AFIOH) Phone: (888) 232-3764. http://www.wpafb.af.mil/afrl/711hpw/usafsam.asp</p>
<p>DOD Force Health Protection and Readiness (FHP & R) Phone: (800) 497-6261. http://fhp.osd.mil</p>