Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS): South Baghdad and Vicinity, Iraq: 2003 to 2011

AUTHORITY: This periodic occupational and environmental monitoring summary (POEMS) has been developed in accordance with Department of Defense (DoD) Instructions 6490.03, 6055.05, and JCSM (MCM) 0028-07, *See (References 1-3).*

PURPOSE: This POEMS documents the Department of Defense (DoD) assessment of occupational and environmental health (OEH) risks for South Baghdad, Al Dora, Combat Outpost (COP) 821 (Saydiyah), COP 863, Joint Security Station (JSS) Doura, COP Falahat, Forward Operating Base (FOB) Falcon, COP Karb de Gla II, JSS Knight, JSS Sadiyah, and FOB White Falcon, Iraq. 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 19 March 2003 through 31 December 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.

This assessment assumes that environmental sampling at South Baghdad 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 19 March 2003 through 31 December 2011.

The POEMS can be useful to inform healthcare providers and others of environmental health conditions experienced by individuals deployed to South Baghdad 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: Baghdad is located along the Tigris River in the flat, low-lying plain of central Iraq. Baghdad has a subtropical arid climate and is the largest city in Iraq. South Baghdad is located to the south and west of the Tigris River. The locations associated with this POEMS (Al Dora, COP 821 (Saydiyah), COP 863, JSS Doura, COP Falahat, FOB Falcon, COP Karb de Gla II, JSS Knight, JSS Sadiyah, and FOB White Falcon) are all located within or near the Rasheed District of Baghdad. Health risk levels are general for the area and may not be specific to each base camp.

The Rasheed District can be divided into East and West Rasheed. East Rasheed houses a refinery complex and power generation plant for Baghdad. East Rasheed is lined by farmland and palm groves near the Tigris River, and it is bordered to the north and east by the river. West Rasheed includes the neighborhoods of Saydiyah, Aamel, Bayaa, Jihad, Furat, Risalah, and Shurta.

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 South Baghdad 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 be associated with potential acute health effects in some personnel during deployment at South Baghdad and vicinity:

Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}); food/waterborne diseases (e.g., bacterial diarrhea, hepatitis A, typhoid fever, diarrhea-cholera, diarrhea-protozoal, brucellosis); other endemic diseases (cutaneous leishmaniasis, Crimean-Congo hemorrhagic fever, sandfly fever, leptospirosis, schistosomiasis, Tuberculosis (TB), rabies, Q fever); and heat stress. For food/waterborne diseases (e.g., bacterial diarrhea, hepatitis A, typhoid fever, diarrhea-cholera, diarrhea-protozoal, brucellosis), 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 (cutaneous leishmaniasis, Crimean-Congo hemorrhagic fever, sandfly fever), these diseases may constitute a significant risk due to exposure to biting vectors; risk reduced to Low by proper wear of the treated uniform, 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 during April through October and 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.

In October 2006, FOB Falcon came under attack and the ammunition holding area (AHA) was struck by what was thought to be a mortar, resulting in a large explosion that was followed by subsequent explosions. Soil samples and bottled water samples were taken near the AHA in the days following the explosion. Analysis of these samples showed that there was low short-term risk from exposure to these media as a result of the AHA explosion (see section 10.8).

Air quality: For PM_{10} and for $PM_{2.5}$, 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. Although not enough samples were taken near the burn pits to evaluate short-term risk, there were burn pits utilized at South Baghdad and Vicinity, Iraq (COP Falahat, FOB Falcon, COP Karb de Gla II, COP 863 and COP 821 (Saydiyah)) – see section 10.9. 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 short-term health 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 South Baghdad and Vicinity, Iraq. 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 be associated with potential chronic health effects in some personnel during deployment at South Baghdad and vicinity:

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

In October 2006, FOB Falcon came under attack and the ammunition holding area (AHA) was struck by what was thought to be a mortar, resulting in a large explosion that was followed by subsequent explosions. Soil samples and bottled water samples were taken near the AHA in the days following the explosion. Analysis of these samples showed that there was low long-term risk from exposure to these media as a result of the AHA explosion (see section 10.8).

Air quality: For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$), long-term risk was not

evaluated due to insufficient sample size. Although particulate matter less than 10 micrometers in diameter (PM_{10}) was not evaluated for long-term risk due to no available health guidelines, the area was a dusty desert environment. In addition, though there were not enough burn pit samples available for long-term assessment, there were burn pits present at South Baghdad and Vicinity, Iraq (COP Falahat, FOB Falcon, COP Karb de Gla II, COP 863 and COP 821 (Saydiyah)) – see section 10.9. For inhalational exposure to high levels of dust, PM_{10} 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 pits are 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, incinerators, 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 – South Baghdad 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 micrometers in diameter (PM_{10})	Short-term: High to Low, 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
Particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$)	Short-term: Data quality 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: Data quality insufficient to characterize risk.
	Long-term: Data quality insufficient to characterize risk.		Long-term: Data quantity insufficient to characterize risk.
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, Crimean-Congo hemorrhagic fever, Sandfly fever) to Low (Rickettsioses, West Nile fever, Typhus-murine, Sindbis).	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 (Leptospirosis and Schistosomiasis)		Short-term: Moderate (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, Anthrax, Q-fever), Low (H5N1 Avian Influenza)	Prohibiting contact with, adoption, or feeding of feral animals in accordance with U.S. Central Command (CENTCOM) General Order (GO) 1B. Risks are further reduced in the	Short-term: Low to none
	Long-term: Low (Rabies)		Long-term: No data available

		event of assessed contact by prompt post-exposure rabies prophylaxis IAW The Center for Disease Control's (CDC) Advisory Committee on Immunization Practices guidance.	
VENOMOUS ANIMAL/ INSECTS			
Snakes, scorpions, and spiders	Short-term: Low, if encountered, effects of venom vary with species from mild localized swelling (e.g., *Scorpiops lindberg*) to potentially lethal effects (e.g.,*Gloydius halys*).	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., *Scorpiops lindberg*) to potentially lethal effects (e.g., *Gloydius halys*).
	Long-term: Not an identified source of health risk.		Long-term: No data available
HEAT/COLD STRESS			
Heat	Short-term: High to Low, High health risk of heat injury in unacclimatized personnel.	Work-rest cycles, proper hydration and nutrition, and Wet Bulb Globe Temperature (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 hydration and nutrition, and proper wear of issued protective clothing.	Short-term: Low risk of cold stress/injury.
	Long-term: Low, Long-term health implications from cold injuries 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.	Hearing protection used by personnel in higher risk areas.	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	See Section 10.3	Short-term: Low
	Long-term: Low		Long-term: Low
Ammunition Holding Area Explosion	Short-term: Low health risk from the incident.	See Section 10.8	Short-term: Low health risk from the incident.
	Long-term: Low health risk from the incident.		Long-term: Low health risk from the incident.

<table>
<tr><td rowspan="2">Burn Pits</td><td>Short-term: The DoD recognizes that acute symptoms due to smoke exposure may occur, including reddened eyes, irritated respiratory passages, and cough that may persist for some time.</td><td rowspan="2">Control measures may have included locating burn pits downwind of prevailing winds, increased distance from living and working areas when possible, and improved waste segregation and management techniques</td><td>Short-term: The DoD recognizes that acute symptoms due to smoke exposure may occur, including reddened eyes, irritated respiratory passages, and cough that may persist for some time.</td></tr>
<tr><td>Long-term: While no long-term health risks have yet been identified at a population-level, it is plausible that a smaller number of Service members may be affected by longer-term health effects.</td><td>Long-term: While no long-term health risks have yet been identified at a population-level, it is plausible that a smaller number of Service members may be affected by longer-term health effects.</td></tr>
<tr><td colspan="4">[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 South Baghdad 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 environmental sampling data and reports obtained from 19 March 2003 through 31 December 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 South Baghdad 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 USAPHC/Army Institute of Public Health (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.</td></tr>
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1 Discussion of Health Risks at South Baghdad 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 U. S. Army Public Health Command Technical Guide 230, *Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel* (Reference 4). All OEH risk estimates represent residual risk after accounting for preventive controls in place. Occupational exposures and exposures to endemic diseases are greatly reduced by preventive measures. For environmental exposures related to airborne dust, there are limited preventive measures available, and available measures have little efficacy in reducing exposure to ambient conditions.

2 Air

2.1 Site-Specific Sources Identified

Personnel deployed to South Baghdad and vicinity were exposed to various airborne contaminants as identified by monitoring and sampling efforts between 19 March 2003 and 31 December 2011. Sources of airborne contaminants at the base camp included diesel vehicle and generator exhaust, a brick factory located within four miles north of the FOB, dust from unpaved roads and surfaces, on-site 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.

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 ($PM_{2.5}$), which can reach the deepest regions of the lungs when inhaled. Exposure to excessive PM is linked to a variety of potential health effects.

2.3 Particulate Matter, less than 10 microns (PM_{10})

2.3.1 Exposure Guidelines:

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

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

Long-term (1-year) PM_{10} MEG ($\mu g/m^3$):

- Not defined and not available.

2.3.2 Sample data/Notes:

A total of 32 valid PM_{10} air samples were collected from 2004, 2006, and 2008-2010. The range of 24-hour PM_{10} concentrations was 105 $\mu g/m^3$ – 4593 $\mu g/m^3$ with an average concentration of 571 $\mu g/m^3$. There is low confidence associated with higher concentrations because once PM_{10} concentrations get above 1000 $\mu g/m^3$ there is no guarantee that the value is strictly PM_{10}, and it could be Total Suspended Particulate.

There were no sampling data for 2003, 2005, 2007 and 2011.

2.3.3 Short-term health risk:

Variable (High to Low): The short-term PM_{10} health risk assessment estimate was low to high based on typical and peak PM_{10} concentrations, and the likelihood of exposure at these hazard severity levels. A low short-term health risk assessment estimate for typical PM_{10} exposure concentrations at South Baghdad suggested the expected losses may have little or no impact on accomplishing the mission. A high short-term health risk assessment estimate for peak PM_{10} 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 (Reference 4, Table 3-2). Daily average health risk levels for PM_{10} show no hazard for 18.8%, low health risk for 50%, moderate health risk for 15.6%, and high health risk for 15.6% of the time.

The hazard severity was marginal for average PM_{10} sample concentrations. The results indicated that a majority of personnel may have experienced notable eye, nose and throat irritation and some respiratory effects. Some lost-duty days may be expected. Those with a history of asthma or cardiopulmonary disease may experience increased symptoms (Reference 4, 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 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 4, Table 3-10).

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

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

2.4.1 Exposure Guidelines:

Short Term (24-hour) $PM_{2.5}$ MEGs (μg/m^3):

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

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

- Negligible MEG = 15
- Marginal MEG = 65

2.4.2 Sample data/Notes:

A total of three valid $PM_{2.5}$ air samples were collected at South Baghdad from 5 November to 13 November 2009. The range of 24-hour $PM_{2.5}$ concentrations was 107 μg/m^3 – 164 μg/m^3 with an average concentration of 130 μg/m^3.There were no sampling data for 2003-2008 and 2010-2011.

2.4.3 Short-term health risk:

Not Evaluated: There are not enough data to assess this risk.

2.4.4 Long-term health risk:

Not Evaluated: There were not enough data to assess this risk.

2.5 Airborne Metals from PM_{10}

2.5.1 Sample data/Notes:

A total of 32 valid PM_{10} airborne metal samples were collected at South Baghdad in 2004, 2006, and 2008-2010. There were no sampling data for 2003, 2005, 2007 and 2011.

2.5.2 Short-term health risks:

None identified based on the available sampling data.

2.5.3 Long-term health risks:

Vanadium had an average concentration (0.09746 μg/m^3) that exceeded the long-term 1-Year negligible MEG (0.068 μg/m^3). The long-term health risk assessment for PM_{10} airborne vanadium concentrations was low based on average PM_{10} vanadium concentrations. Therefore, there was no specific medical action required for long-term exposure to PM_{10} vanadium.

The hazard severity was negligible for long-term PM_{10} vanadium exposures in South Baghdad. During long-term exposures at the negligible hazard severity level, few exposed personnel (if any) were expected to develop delayed onset, irreversible effects. Confidence in the health risk assessment was low (Reference 4, Table 3-10).

2.6 Volatile Organic Compounds (VOCs)

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

2.6.1 Sample data/Notes:

A total of 27 valid VOCs air samples were collected from South Baghdad from June 2006-June 2008. There were no sampling data for 2003-2005 and 2009-2011.

2.6.2 Short and long-term health risks:

None identified based on available sampling data. However, the data quantity was insufficient to characterize the potential short-term and long-term health risk from VOCs exposure to U.S. personnel. Confidence in the risk estimate is low (Reference 4, Table 3-6).

3 Soil

3.1 Site-Specific Sources Identified

3.1.1 Sample data/Notes:

A total of 23 surface soil samples from South Baghdad were collected at Al Dora (n=3), JSS Doura (n=3), COP Falahat (n=1), FOB Falcon (n=14), COP Karb de Gla II (n=1), and JSS Knight (n=1) from 2003 - 2010 to assess OEH health risk to deployed personnel. The primary soil contamination exposure pathways were dermal contact and dust inhalation. Typical parameters analyzed for included semivolatile organic compounds, heavy metals, polychlorinated biphenyls, insecticides, fungicides, herbicides, and polycyclic aromatic hydrocarbons (PAHs). For the risk assessment, personnel were assumed to remain at this location for 6 months to 1 year. No health hazards were identified from surface soil samples collected.

There were no sampling data for 2007 and 2011.

3.1.2 Short-term 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. 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 South Baghdad and vicinity was bottled water and Reverse Osmosis Water Purification Unit (ROWPU)-treated water.

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 L/day of bottled water for up to 365 days (1-year). A total of two valid bottled water samples were collected on 4 November 2006 from FOB Falcon and four ROWPU-treated water samples used for secondary drinking were collected between 3 March 2004 and 29 December 2008. No 1 year negligible MEGs were exceeded. No health risks from bottled water exposures were identified based on limited sample data.

4.1.3 Short and long-term health risk:

The data quantity was insufficient to characterize the potential short-term and long-term health risk**.**

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

Although the primary route of exposure for most microorganisms was ingestion of contaminated water, dermal exposure to some microorganisms, chemicals, and biologicals may also have caused 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.

4.2.1 Site-Specific Sources Identified

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

4.2.2 Sample data/Notes

Non-drinking water samples were ROWPU-treated (n=9) and municipal (n=4). Dermal, inhalation, and incidental ingestion exposures that result from non-drinking use of water sources during showering, personal hygiene and/or cooking were considered incidental ingestion and evaluated as nondrinking exposures (See Reference 4, Appendix G, and Section G.3). In case of incidental ingestion of the non-drinking water sources, or in instances of ice production in dining facilities, water was assumed to have been ingested at less than 5 L/day for up to 365 days (1-year). No health risks from ROWPU-treated (non-drinking) and municipal exposures were identified based on limited sample data. None of the available samples exceeded their 1 year negligible MEGs for any parameters.

4.2.3 Short-term and long-term health risk:

There was not enough data to evaluate a potential short-term or long-term health risk. Confidence in risk estimate is low because of the small sample size (Reference 4, Table 3-6).

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 Exposure Surveillance Library (MESL) from 19 March 2003 through 31 December 2011 timeframe.

5.1.1 Short and long-term health risks:

Not Evaluated.

5.2 Depleted Uranium (DU):

No specific hazards were documented in the DOEHRS or MESL data portals from the 2003 through 2011 timeframe (References 1 and 5).

5.3 Ionizing Radiation:

No specific hazards were documented in the DOEHRS or MESL data portals from the 2003 through 2011 timeframe (References 1 and 5).

5.4 Non-Ionizing Radiation:

No specific hazards were documented in the DOEHRS or MESL data portals from the 2003 through 2011 timeframe (References 1 and 5).

6 Endemic Disease[1]

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. CENTCOM Modification (MOD) 11 (Reference 8) lists deployment requirements, to include immunization and chemoprophylaxis, in effect during the timeframe of this POEMS.

6.1 Foodborne and Waterborne Diseases

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

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

6.1.1 Diarrheal diseases (bacteriological)

High, mitigated to Low: Unmitigated health risk to U.S. personnel was high year round. Diarrheal diseases (bacteriological) could be expected to temporarily incapacitate a very high percentage of

[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.

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

6.1.3 Typhoid/paratyphoid Fever

High, mitigated to Low: Unmitigated health risk to U.S. personnel was high year round. 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, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate year round. 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, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate year round. 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, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate year round. 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 moderate year round. 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:

Low: The overall short-term unmitigated health risk associated with other foodborne and waterborne diseases at South Baghdad and vicinity was considered high (bacterial diarrhea, hepatitis A, typhoid fever), to moderate (diarrhea-protozoal, diarrhea-cholera, brucellosis), to low (Hepatitis E) if local food or water was consumed. Preventive Medicine measures reduced the risk to low. 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 the warmer months (typically from April through November), the climate and ecological habitat support populations of arthropod vectors, including mosquitoes, ticks, and sandflies, with variable rates of disease transmission. 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 Sandfly fever
Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate with seasonal transmission (May-June and September-October). Sandfly fever potential disease rates are 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.

6.2.3 Leishmaniasis
Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate with seasonal transmission (April-November). 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.

6.2.4 Crimean-Congo hemorrhagic fever
Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate year round. 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%.

6.2.5 Typhus-murine (fleaborne)
Low: Unmitigated health risk to U.S. personnel was low year round. Typhus-murine (fleaborne) is present in the region; rare cases are possible among personnel exposed to rodents (particularly rats) and fleabites. Typhus-murine is a debilitating febrile illness typically requiring 1 to 7 days of inpatient care, followed by return to duty.

6.2.6 Rickettsioses
Low: Unmitigated health risk to U.S. personnel was low with seasonal transmission (April-November). Rickettsioses disease was present in the region; rare cases were possible among personnel exposed to tick bites. Incidents can result in a potentially debilitating febrile illness, which may require 1 to 7 days of supportive care followed by return to duty. More prolonged and severe infections may occur with rare fatalities. Fatality rates in untreated cases may be higher.

6.2.7 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.

6.2.8 Sindbis

Low: Unmitigated health risk to U.S. personnel was low with seasonal transmission (April-November). Extremely rare cases could occur among personnel exposed to mosquito bites. Sindbis is a debilitating febrile illness often accompanied by rash, typically requiring 1 to 7 days of supportive care. Significant arthralgias can persist for several weeks or more in some cases.

6.2.9 Short-term health risks:

Low: The overall short-term unmitigated health risk associated with arthropod vector-borne diseases at South Baghdad and vicinity was considered high (malaria) to moderate (sandfly fever, leishmaniasis (cutaneous and visceral), typhus-miteborne and Crimean-Congo hemorrhagic fever) to low (West Nile fever, Rickettsioses, typhus-murine, 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 (Reference 4, Table 3-6).

6.2.10 Long-term health risks:

Low: The long-term unmitigated health 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. 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: Unmitigated health risk to U.S. personnel was moderate with seasonal transmission (April-November). Leptospirosis is present in Iraq but at unknown levels. Human infection occurs through exposure to water or soil contaminated by infected animals and has been 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 pass directly into surface waters. Leptospirosis can enter the body through cut or abraded skin, mucous membranes, and conjunctivae. Ingestion of contaminated water can also lead to infection. The acute generalized illness associated with infection can 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.

6.3.2 Schistosomiasis

Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate with seasonal transmission (April-November). Schistosomiasis can occur in rare cases (less than 0.1% per month attack rate) among personnel wading or swimming in fecally contaminated bodies of water such as lakes, streams, or irrigated fields. Mild infections are generally asymptomatic. In very heavy acute infections, a febrile illness (acute schistosomiasis) may occur, especially with *S. japonicum* and *S. mansoni*, requiring hospitalization and convalescence over 7 days.

6.3.3 Short-term health risks:

Low: The overall short-term unmitigated health risk associated with water contact diseases at South Baghdad and vicinity was considered moderate (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. 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. Additional mitigation included active case isolation in negative pressure rooms, where available.

6.4.1 Tuberculosis (TB)

Moderate, mitigated to Low: 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. 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.

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.

6.4.3 Short-term health risks:
Low: The overall short-term unmitigated health risk associated with respiratory diseases at South Baghdad and vicinity was considered moderate (tuberculosis) to low (meningococcal meningitis). Preventive measures reduced the health risk to low. 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, mitigated to Low: 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. 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. 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. Although, 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, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate year round. Rare cases were possible among personnel exposed to aerosols from infected animals, with clusters of cases possible in some situations. Significant outbreaks (affecting 1-50 percent) could occur in personnel with heavy exposure to barnyards or other areas where animals are kept. Unpasteurized milk may also transmit infection. The primary route of exposure is respiratory, with an infectious dose as low as a single organism. Q-Fever is a debilitating febrile illness, sometimes presenting as pneumonia, typically requiring 1 to 7 days of inpatient care followed by return to duty. Mitigation strategies include consuming approved food sources, avoidance of animals and farms, dust abatement when working in these areas (wet mop, water sprayed on high volume traffic areas, etc.), and proper PPE for personnel working with animals.

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

areas (wet mop, water sprayed on high volume traffic areas, etc.), and proper PPE for personnel working with animals, and immunization.

6.5.4 H5N1 avian influenza

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

6.5.5 Short-term health risks:

Low: The overall short-term unmitigated health risk associated with animal contact diseases at South Baghdad and vicinity was considered moderate (rabies, Q-fever) to low (anthrax, H5N1 avian influenza). Preventive measures reduced the health risk to low. 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 10). The species listed below have home ranges that overlap the location of South Baghdad and vicinity, and may present a health risk if they are encountered by personnel.

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.*

- *Compsobuthus matthiesseni*, *Compsobuthus werneri, Orthochirus iraqus*, and *Orthochirus scrobiculosus*: Clinical effects unknown; there are a number of dangerous Buthid scorpions, but there are also some known to cause minimal effects only. Without clinical data it is unclear where this species fits within that spectrum.

- *Scorpio maurus*: Mild envenoming only, not likely to prove lethal. Stings by these scorpions are likely to cause only short-lived local effects, such as pain, without systemic effects.

- *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

- *Macrovipera lebetina* subspecies e*uphratica* and subspecies *obtusa*: Severe envenoming possible, potentially lethal. Moderate to severe coagulopathy and haemorrhagins causing extensive bleeding. Renal damage is a recognized complication, usually secondary to coagulopathy. All cases should be managed as potentially severe.

- *Pseudocyclophis persicus*: Clinical effects unknown, but unlikely to cause significant envenoming, most unlikely to be dangerous. Limited clinical data suggest bites result in local effects only. Carefully assess. Role of antivenom most uncertain and unlikely to be required.

- *Walterinnesia aegyptia*: Clinical effects are unknown, but potentially lethal envenoming, though unlikely, cannot be excluded. Bites are poorly documented, but expect local pain, swelling, probably not necrosis, general systemic effects, and possibly flaccid paralysis. Antivenom is available; use at first sign of paralysis or for intractable general systemic effects, such as persistent vomiting not responding to antiemetics.

7.4 Short-term health risk:

Low: If encountered, effects of venom vary with species from mild localized swelling (e.g., *S. maurus*) to potentially lethal effects (e.g.,*V. albicornuta*). See effects of venom above. Mitigation strategies included avoiding contact, proper wear of uniform (especially footwear), and timely medical treatment. Confidence in the health risk estimate is low (Reference 4, Table 3-6).

7.5 Long-term health risk:

None identified.

8 Heat/Cold Stress

8.1 Heat

Average daily peak temperature during the summer months (June – September) is 107.5 degrees Fahrenheit (°F) with an average monthly peak temperature of 88°F over the entire year. 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.

8.1.1 Short-term health risk:

High. Extremely high health risk of heat injury in unacclimatized personnel, susceptible populations (older, previous history of heat injury, poor physical condition, underlying medical/health conditions), and those under operational constraints (equipment, PPE, vehicles) from May – October; high risk for April, and low from November – March. Mitigation strategies included acclimatization, implementation of work-rest cycles, proper nutrition and hydration, and the use of cooling tents, when available. Because the occurrence of heat stress/injury is strongly dependent on operational factors (work intensity and clothing), confidence in the health risk estimate is low (Reference 4 Table 3-6).

8.1.2 Long-term health risks:

Low. Long-term health implications from heat injuries are rare but can occur, especially from more serious injuries such as heat stroke. 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. The long-term health risk is Low; confidence in the health risk estimates is medium (Reference 4 Table 3-6).

8.2 Cold

Even on warm days there can be a significant drop in temperature after sunset by as much as 40°F. There is a risk of cold stress/injury when temperatures fall below 60 °F, which can occur from October - April. The health risk assessment for non-freezing cold injuries (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. With protective measures in place the health risk assessment is low for cold stress/injury; confidence in the health risk estimate is medium.

8.2.1 Short-term health risks:

Low. The risk of cold injury was low. Mitigation strategies included the use of the buddy system, limiting exposure during cold weather, proper wear of issued protective clothing, proper nutrition and hydration, and the use of warming tens, when available. Confidence in the health risk estimate is medium.

8.2.2 Long-term health risk:

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

9 Noise

9.1 Continuous:

No specific hazards were documented in the DOEHRS or MESL data portals from the 2003 through 2011 timeframe (References 1 and 5).

9.2 Impulse:

No specific hazards were documented in the DOEHRS or MESL data portals from the 2003 through 2011 timeframe (References 1 and 5).

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 that 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 Fuel/Petroleum Products/Industrial Chemical Spills

The prior use of FOB Falcon by the Iraqis resulted in oil and fuel spills that were documented throughout the base. All U.S. soldiers who lived in this area were briefed on what areas were off limits, and what areas could be occupied. In addition, areas with oil and fuel spills were plowed over and not used on a daily basis by U.S. soldiers, so there was minimal interaction with the spills. Petroleum spills were not a documented problem at the other locations.

10.2.1 Short-term and Long-term health risks

Not evaluated: Insufficient quantity and quality of data were available for an accurate health risk assessment.

10.3 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 were employed. Enclosed bait stations for rodenticides; various handheld equipment for spot treatment of insecticides and herbicides; and a number of ready-to-use (RTU) methods such as aerosol cans and baits were used. The control of rodents required the majority of pest management inputs, with the acutely toxic rodenticides staged as solid formulation lethal baits placed in tamper-resistant bait stations indoors and outdoors throughout cantonment areas. Nuisance insects, including biting and stinging insects such as bees, wasps, and ants, also required significant pest management inputs. Use of pesticides targeting against these pests generally involved selection of compounds with low mammalian toxicity and short-term residual using pinpoint rather than broadcast application techniques. No specific hazard sources were documented in DOEHRS or MESL data portal. Nineteen monthly pesticide application reports in the MESL for FOB Falcon (January 2005 to July 2006) listed the usage of pesticides on the site. Kellogg Brown & Root (KBR) was the contractor for all of the reports.

10.3.1 Rodenticides

Methods used to control rodents at FOB Falcon included Maki Bait Packs, Contrac Blox, Catchmaster 24R, box traps, and snap traps.

10.3.2 Insecticides

Methods used to control mosquitoes, ants, roaches, and spiders at FOB Falcon included: Advance Ant Bait, Advance Ant Bait 375A, Altosid Briquets, Altosid XR Briquettes, Bluestreak Fly Bait, Catchmaster Fly Stick, Catchmaster MaxCatch Glue Trap, Cy-Kick, Cy-Kick CS, Delta Dust, Delta Guard G, Demand Pestabs, Gold Stick Fly Trap, Masterline Permethrin Plus-C, Maxforce Ant Bait Stations, Maxforce Ant Puck, Maxforce FC Bait Puck, PT 565 Plus XLO, Subterfuge, Tempo SC Ultra, Trapper Glue Board, and Wasp Freeze.

10.3.3 Short-term and Long-term health risks

Low: Mitigation strategies included an Integrated Pest Management Plan, proper pesticide application/storage, and use by trained and certified personnel. Confidence in the health risk assessment is medium (Reference 4, Table 3-6).

10.4 Food Sanitation

A search of the DOEHRS and MESL from 19 March 2003 to 31 December 2011 yielded limited food sanitation inspection records in the locations associated with South Baghdad. The deficiencies summarized below were found at dining facilities within South Baghdad at different times from March 2003 to December 2011.

Wooden pallets were being used for dunnage. Food was being stored under an open stairwell. Food was being stored at incorrect temperatures. Food was not being heated to correct temperature. Garbage dumpsters were overflowing. Hot water was not operational. A garbage can and hand wash station were missing behind a serving line. Grease container covers were missing. Low chlorine level in sanitizing solution. There were uncovered trashcans. Temperature measuring devices were out of calibration. There was no plumbing for grey water; created pooling on ground.

10.4.1 Short-term and Long-term health risks

Not evaluated: Insufficient quantity and quality of data were available for an accurate health risk assessment.

10.5 Solid Waste Sites/Waste Disposal:

Based on available information, COP Falahat, FOB Falcon, COP Karb de Gla II, COP 863 and COP 821 (Saydiyah) utilized burn pits. The burn pit at FOB Falcon was replaced with an incinerator. The exact date the incinerator became operational is unknown, but it is mentioned in a 2009 OEHSA, and incinerator ash samples were taken in September 2009. Waste from JSS Knight, JSS Sadiyah, and JSS Doura was gathered and hauled from the locations. Information on waste sites/waste disposal was not identified for Al Dora and White Falcon. Any medical waste that was generated was collected in red sharps containers and ultimately hauled to the Victory Base Complex.

10.4.1 Short-term and Long-term health risks

Not evaluated. Insufficient quantity and quality of data were available for an accurate health risk assessment.

10.6 Lead- based Paint

No specific hazards were documented in the DOEHRS or MESL data portals from the 2003 through 2011 timeframe (References 1 and 5).

10.7 Asbestos

Asbestos containing materials (ACM) were common in east Europe, Middle East, Indian subcontinent, and Asia because it was a very good thermal insulator, fire retardant and binder in friction products, and it was inexpensive to make. Exposure to airborne friable asbestos may have resulted in a potential health risk because persons breathing the air may have breathed in asbestos fibers. Continued exposure may have increased the amount of fibers that remain in the lungs. Fibers embedded in lung tissue over time may have caused serious lung diseases including asbestosis, lung cancer, or mesothelioma. Smoking increases the risk of developing illness from asbestos exposure. If the ACM was not friable then the asbestos did not present a significant health hazard. However without proper controls, ACM may have presented an elevated risk to soldiers if it was in poor

condition, friable, or if the material was disturbed, such as in maintenance operations, renovations, or demolitions.

No specific ACM hazard sources were documented in the DOEHRS or MESL from 2003 through 2011 timeframe (References 1 and 5).

10.8 Ammunition Holding Area Explosion:

In October 2006, FOB Falcon came under attack and the ammunition holding area (AHA) was struck by what was thought to be a mortar, resulting in a large explosion that was followed by subsequent explosions.

10.8.1 Sample data/Notes:
Ambient soil samples and bottled water samples were taken near the AHA in the days following the explosion. Analysis of these samples showed that there was low risk from exposure to these media as a result of the AHA explosion.

10.8.2 Short-term health risk:
None identified based on available data.

10.8.3 Long-term health risk:
None identified based on available data.

10.9 Burn Pits

COP Falahat, FOB Falcon, COP Karb de Gla II, COP 863 and COP 821 (Saydiyah) utilized burn pits for disposal of solid waste, according to documentation in the MESL for 19 March 2003 through 31 December 2011.

While not specific to South Baghdad 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 12). The Institute of Medicine committee's (Reference 12) review of the literature and the data suggests that service in Iraq or Afghanistan (i.e., a broader consideration of air pollution than exposure only to burn pit emissions) may be associated with long-term health effects, particularly in susceptible (e.g., those who have asthma) or highly exposed subpopulations, such as those who worked at the burn pit. Such health effects would be due mainly to high ambient concentrations of PM from both natural and anthropogenic sources, including military sources. If that broader exposure to air pollution turns out to be relevant, potentially related health effects of concern are respiratory and cardiovascular effects and cancer. Susceptibility to the PM health effects could be exacerbated by other exposures, such as stress, smoking, local climatic conditions, and co-exposures to other chemicals that affect the same biologic or chemical processes. Individually, the chemicals measured at burn pit sites in the study were generally below concentrations of health concern for general populations in the United States. However, the possibility of exposure to mixtures of the chemicals raises the potential for health outcomes associated with cumulative exposure to combinations of the constituents of burn pit emissions and emissions from other sources.

10.9.1 Particulate matter, less than 10 micrometers (PM_{10}), associated with a burn pit

10.9.1.1 Sample data/Notes
Exposure Guidelines:

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

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

Long-term (1-year) PM_{10} MEG ($\mu g/m^3$):

- Not defined and not available.

A total of two valid PM_{10} air samples were collected from 21 - 22 June 2008 in the vicinity of a burn pit at FOB Falcon within South Baghdad. The range of 24-hour PM_{10} concentrations was 505 μg/m3 – 639 $\mu g/m^3$ with an average concentration of 572 $\mu g/m^3$. The average PM_{10} concentration was above the short-term PM_{10} negligible MEG but below the short-term critical MEG.

10.9.1.2 Short-term and Long-term health risks:
Data were insufficient to characterize short-term health risk associated with PM_{10} exposure from burn pits at South Baghdad. There are no available health guidelines to characterize the long-term health risk associated with PM_{10} exposure. 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.

10.9.2 Airborne Metals from PM_{10}, associated with a burn pit

10.9.2.1 Sample data/Notes:
The health risk assessment was based on average and peak concentration of two valid PM_{10} airborne metal samples collected from 21 - 22 June 2008 in the vicinity of an Iraqi burn pit at FOB Falcon within South Baghdad. None of the analyzed metals in the collected samples were found at concentrations above the 1-year negligible MEGs.

10.9.2.2 Short and long-term health risks:
Data were insufficient to characterize short and long-term health risk associated with metals from PM_{10}. However, all detected contaminants were below applicable 1-year negligible MEGs.

11 References[2]

1. 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 Instruction 6490.03, *Deployment Health*, 2006.

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

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

4. USAPHC TG230, June 2010 Revision, Final Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel TG230.

5. DOD MESL Data Portal: https://mesl.apgea.army.mil/mesl/. Some of the data and reports used may be sensitive or otherwise have some restricted distribution.

6. 30th HBCT, Occupational Environmental Health Site Assessment, Falcon, Iraq, 29 August 2009.

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

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

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

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

11. 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.

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

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[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.

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).
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
Navy and Marine Corps Public Health Center (NMCPHC) (formerly NEHC) Phone: (757) 953-0700. www.nmcphc.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