Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Kabul and vicinity, Afghanistan, Calendar Years: Calendar Years 2010 to 2012

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 base camp level Occupational and Environmental Health Surveillance (OEHS) exposure data for the Kabul International Airport (KAIA), U.S. Embassy, New Kabul Compound, Kabul Military Training Center, Kabul International Security Assistance Force, Camp Eggers, Camp Julien, Camp Dubbs, Camp Morehead, Camp Phoenix, Camp Blackhorse and Camp Pol-e-Charki. It presents the identified health risks and assessments along with the possible associated medical implications. The findings were based on information collected from 01 January 2010 through 03 January 2012 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. While this assessment, and the previous POEMS produced for Camps Phoenix and Eggers for the 2003-2010 timeframe, may reflect similar exposures and health risks pertaining to historic or future conditions at this site, the underlying data were limited to the time period(s) and area(s) sampled and thus may not reflect fluctuations or unique occurrences. It also may not have been fully representative of all the fluctuations during the timeframe. To the extent that the data allowed, this summary describes the general ambient conditions at the site and characterizes the health risks at the *population–level*. While useful to inform providers and others of potential health effects and associated medical implications, it does not represent an individual exposure profile. Actual individual exposures and specific resulting health effects depend on many variables and, should be addressed in individual medical records by providers as appropriate at the time of an evaluation of a unique exposure.

SITE DESCRIPTION: Kabul is the capital and largest city of Afghanistan. It is also the capital of Kabul Province, located in the eastern section of Afghanistan. The population of the Kabul metropolitan area in 2012 was estimated to be around 5 million from a population of 3.5 million in 2010. It is situated 5,900 feet (ft) above sea level in a narrow valley and along the Kabul River. It is bordered by two steep mountain ranges. It has a semi-arid, continental climate with precipitation concentrated in the winter (sometimes falling as snow) and spring months. Summers are long and hot (temperatures range up to 90^{o} F) but have very low humidity. Autumn, in October and November, is warm and dry. Winters are cold, lasting from December to March (temperature range: 19-40°F). Spring is the wettest time of the year (average rainfall for March is 3 inches). Industries in the Kabul area include rayon and wool mills, food processing plants, furniture factories and marble works. Though Kabul has the most developed industrial sector in Afghanistan, it lacks the infrastructure required for industrial development. Kabul is quickly becoming a center of international trade, however.

Camp Phoenix is approximately 6 miles southeast of KAIA and was originally a huge junkyard at an abandoned tractor trailer park. It is populated mainly by U.S. and other NATO armed forces, along with a number of U.S. and local national contractors who support military personnel in logistical and operational roles. It is the home of the Kabul Base Cluster Installation Command, a collection of Army National Guard units tasked to train the Afghan National Army. The 981st Medical Detachment (Preventive Medicine) also occupied space on Camp Phoenix. They are responsible for maintaining military public health in the Kabul area.

Camp Julien was closed in November 2005 and was handed over to the Government of Afghanistan. In April 2007 it was reopened and designated as the new home for the Counterinsurgency (COIN) Academy. It is a multinational organization that runs a week-long course designed to teach military leaders the basics of counterinsurgency operations.

The Afghan National Army's Pol-e-Charki base is co-located with Camp Blackhorse, approximately 10 miles east of Kabul.

SUMMARY: Summarized below were the key health risks estimates that presented a moderate or greater risk of medical concern along with recommended follow-on medical actions, if any, that providers should be aware of. A Table on the following pages provides a list of all the identified health risks at Kabul and vicinity (Table 1). As indicated in the detailed sections that follow the table, controls that have been effectively established to reduce health risk levels have been factored into this overall assessment. In some cases, e.g. ambient air, specific controls are noted but not routinely available/feasible.

Short-term health risks & medical implications:

The following may have caused acute health effects in some personnel during deployment at Kabul and vicinity:

Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}); inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$); food/waterborne diseases (e.g., bacterial diarrhea, hepatitis A, typhoid fever, brucellosis, diarrhea-cholera, diarrhea-protozoal, hepatitis E); other endemic diseases (malaria, cutaneous leishmaniasis, Crimean-Congo hemorrhagic fever, sandfly fever, typhus-miteborne, leptospirosis, Tuberculosis (TB), rabies, Q fever); venomous animals/insects; and heat stress. For food/waterborne diseases (e.g., bacterial diarrhea, hepatitis A, typhoid fever, brucellosis, diarrhea-cholera, diarrhea-protozoal, hepatitis E), if ingesting local food and water, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (hepatitis A, typhoid fever, brucellosis, hepatitis E). Risks from food/waterborne diseases may have been reduced with preventive medicine controls and mitigation, which includes hepatitis A and typhoid fever vaccinations and only drinking from approved water sources in accordance with standing CENTCOM policy. For other vector-borne endemic diseases (malaria, cutaneous leishmaniasis, Crimean-Congo hemorrhagic fever, sandfly fever, typhus-miteborne), 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) activities involving extensive contact with surface water increase risk. For respiratory diseases (Tuberculosis (TB)), personnel in close-quarter conditions with infected individuals could have been at risk for person-to-person spread. Animal contact diseases (rabies, Q fever), pose year-round risk. For venomous animals and insects, if encountered, effects of venom varied with species from mild localized swelling (e.g. widow spider) to potentially lethal effects (e.g. Haly's Pit Viper); risks reduced by avoiding contact and proper and timely treatment. 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.

Air quality: For PM_{10} and $PM_{2.5}$, exposures may result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel while at this site. 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. Likewise, for burn pits, exposures to high levels of PM_{10} and $PM_{2.5}$ in the smoke may also result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups while at this site.

Although most effects from exposure to particulate matter and burn pit smoke should have resolved post-deployment, providers should be prepared to consider the relationship between deployment exposures and current complaints. Some individuals may have sought treatment for acute respiratory irritation during their time at Kabul and vicinity. Personnel who reported with symptoms or required treatment while at this site should have exposure/treatment noted in medical record (e.g., electronic medical record 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 Kabul and vicinity include inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$).

Air Quality: For inhalational exposure to high levels of dust and $PM_{2.5}$, such as during high winds or dust storms or from burn pits, 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 PM exposures are documented and archived, at this time there are 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 exposures, or specific personal dosimeter data) and individual behaviors 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).

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Table 1. Population-Based Health Risk Estimates - Kabul and vicinity, Afghanistan [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: Moderate, Daily levels varied, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects were possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).		Short-term: Moderate, Daily levels varied, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects were possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).
	Long-term: No health guidelines		Long-term: No health guidelines
$PM_{2.5}$	Short-term: High, A majority of the time mild acute (short term) health effects were anticipated; certain peak levels may have produced mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may have been exacerbated.	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows,and doors.	Short-term: High, A majority of the time mild acute (short term) health effects were anticipated; certain peak levels may have produced mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may have been exacerbated.
	Long-term: Moderate, Small percentage of persons may have been at increased risk for developing chronic conditions (particularly those more susceptible to acute (short term) effects (e.g., those with asthma/existing respiratory diseases).		Long-term: Moderate, Small percentage of persons may have been at increased risk for developing chronic conditions (particularly those more susceptible to acute (short term) effects (e.g., those with asthma/existing respiratory diseases).
Water			
ROWPU-treated water (non-drinking)	Short-term: Low	Potable water used from approved sources	Short-term: Low
	Long-term: Low	Potable water used from approved sources	Long-term: Low
ENDEMIC DISEASE			
Food borne/Waterborne (e.g., diarrhea-bacteriological)	Short-term: Variable: High (bacterial diarrhea, Hepatitis A, Typhoid fever) to Moderate (Diarrhea-cholera, diarrhea-protozoal, Brucellosis and Hepatitis E). If ingesting local food/water, the health effects could have been temporarily incapacitating to personnel (diarrhea) or resulted in prolonged illness (Hepatitis A, Typhoid fever, Brucellosis, Hepatitis E).	Preventive measures included Hepatitis A and Typhoid fever vaccination and consumption of food and water only from approved sources (USCENTCOM MOD 11)	Short-term: Low to none
	Long-term: none identified		Long-term: No data available
Arthropod Vector Borne	Short-term: Moderate (Malaria, leishmaniasis-cutaneous, Crimean-Congo hemorrhagic fever, sandfly fever and typhus-miteborne), Low (West Nile fever, and Plague).	Preventive measures included proper wear of the treated uniform and application of repellent to exposed skin and bed net, 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)		Short-term: No data available
	Long-term: None identified		Long-term: No data available

Respiratory	Short-term: Moderate Tuberculosis (TB) and Low (meningococcal meningitis).	TB was evaluated as part of the PDHA (Post Deployment Health Assessment). A TB skin test was required post-deployment if potentially exposed.	Short-term: Low
	Long-term: None identified		Long-term: No data available
Animal Contact	Short-term: Moderate (Rabies and Q-fever), Low (Anthrax and H5N1 avian influenza)	CENTCOM General Order 1B mitigates rabies exposure risks by prohibiting contact with, adoption, or feeding of feral animals. Risks are further reduced in the event of assessed contact by prompt post-exposure rabies prophylaxis IAW the CDC's ACIP guidelines.	Short-term: No data available
	Long-term: Low (Rabies)		Long-term: No data available
VENOMOUS ANIMAL/ INSECTS			
Snakes, scorpions, and spiders	Short-term: Low: If encountered, effects of venom varied with species from mild localized swelling (e.g. widow spider) to potentially lethal effects (e.g. Haly's Pit Viper).	Risks reduced by avoiding contact and proper and timely treatment	Short-term: Low: If encountered, effects of venom varied with species from mild localized swelling (e.g. widow spider) to potentially lethal effects (e.g. Haly's Pit Viper).
	Long-term: None identified		Long-term: None identified
HEAT/COLD STRESS			
Heat	Short-term: Low to Extremely High	Risks from heat stress may have been reduced with preventive medicine controls, work-rest cycles, and mitigation	Short-term: Low to High
	Long-term: Low		Long-term: Low
Cold	Short-term: Low	Risks from cold stress may have been reduced with protective measures such as use of the buddy system in cold weather, and proper wear of protective clothing.	Short-term: Low
	Long-term: Low		Long-term: Low
NOISE			
Continuous (Flightline, Power Production)	Short-term: Low	Hearing protection used by personnel in higher risk areas	Short-term: Low
	Long-term: Low		Long-term: Low
Unique Incidents/ Concerns			
Pesticides/Pest Control	Short-term: Low	See section 10.2	Short-term: No data available
	Long-term: Low	See Section 10.2	Long-term: No data available
Burn Pits	Short-term: Low	Control measures may have included locating burn pits downwind of prevailing winds, increased distance from troop populations when possible, and improved waste segregation and management techniques.	Short-term: Low

	Long-term: Low		Long-term: Low

[1] This Summary Table provides a qualitative estimate of population-based short- and long-term health risk s associated with the general ambient and occupational environment conditions at Kabul 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 have been present in the environment, if a person did not inhale, ingest, or contact a specific dose of the chemical for adequate duration and frequency, then there may have been no health risk. Alternatively, a person at a specific location may have experienced a unique exposure which could have resulted in a significant individual exposure. Any such person seeking medical care should have their specific exposure documented in an SF600.

[2] This assessment was based on specific data and reports obtained from the January 2010 through January 2012 timeframe. It was considered a current representation of general site conditions but may not reflect certain fluctuations or unique exposure incidents. Acute health risk estimates were generally consistent with field-observed health effects.

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

[4] Health risks in this Summary Table were based on quantitative surveillance thresholds (e.g. endemic disease rates; host/vector/pathogen surveillance) or screening levels, e.g. Military Exposure Guidelines (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 Kabul, Afghanistan by Source

The following sections describe the major source categories of potential health risk that were evaluated at Kabul. For each category, the evaluation process includes identifying what, if any, specific sub-categories/health concerns were present. This initial step resulted in "screening out" certain sub-categories that posed 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 moderate or higher potential health risks.

2 Air

2.1 Site-Specific Sources Identified

Kabul is situated in a dusty semi-arid desert environment. Inhalational exposure to high levels of dust and particulate matter, such as during high winds with dust storms, may have resulted in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel. Additionally, certain subgroups of the deployed forces (e.g., those with pre-existing asthma/cardio pulmonary conditions) were at greatest risk of developing notable health effects.

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

2.2.1 Sample data/Notes:

Exposure Guidelines:
Short-term (24-hour) PM_{10} ($\mu g/m^3$): Negligible MEG=250, Marginal MEG=420, Critical MEG=600.
Long-term PM_{10} MEG ($\mu g/m^3$): Not Available.

Camp Phoenix: A total of 14 valid PM_{10} air samples were collected from April 2010 – December 2010. The range of 24-hour PM_{10} concentrations was 56 $\mu g/m^3$ – 556 $\mu g/m^3$ with an average concentration of 344 $\mu g/m^3$.

2.2.2 Short-term health risks: Camp Phoenix

Low to Moderate: The short-term PM_{10} health risk assessment was low based on average PM_{10} concentrations and the likelihood of exposure at these hazard severity levels. A low health risk assessment for typical exposure concentrations suggests that short-term exposure to PM_{10} at Camp Phoenix was expected to have little or no impact on accomplishing the mission. Daily average health risk levels for PM_{10} show no hazard for 36%, low health risk for 36%, moderate health risk for 14%, and high health risk for 14% of the time. Confidence in the short-term $PM_{2.5}$ health risk assessment was low (Reference 9, Table 3-6).

The short-term PM_{10} health risk assessment was moderate based on peak PM_{10} concentrations and the likelihood of exposure at these hazard severity levels. A moderate health risk assessment for peak exposure concentrations suggests that short-term exposure to peak PM_{10} concentrations at Camp Phoenix was expected to have degraded mission capabilities in terms of the required mission standard and will result in reduced mission capability if hazards occur during the mission. Confidence in the short-term PM_{10} health risk assessment was low (Reference 9, Table 3-6).

The hazard severity was negligible for average PM_{10} exposures. The results indicate that few exposed personnel (if any) are expected to have noticeable health effects during mission. Exposed personnel

are expected to be able to effectively perform all critical tasks during mission operations. Minimal to no degradation of abilities to conduct complex tasks are expected.

For the highest observed PM_{10} exposure, the hazard severity was marginal. During peak exposures at the marginal hazard severity level many exposed persons are expected to have noticeable, but not incapacitating health effects. Observable effects require minimal, if any, medical attention but may reduce some individual physical capabilities and/or may enhance stress-related casualties. Exposed personnel are able to perform most critical tasks. Note: The ability to accomplish complex tasks may be degraded.

2.2.3 Long-term health risk: Camp Phoenix

Not Evaluated-no available health guidelines. The U.S. Environmental Protection Agency has retracted its long-term standard (NAAQS) for PM_{10} due to an inability to clearly link chronic health effects with chronic PM_{10} exposure levels.

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

2.3.1 Sample data/Notes:

Exposure Guidelines:
Short-term (24-hour) $PM_{2.5}$ MEGs ($\mu g/m^3$): Negligible MEG=65, Marginal MEG=250, Critical MEG=500.
Long-term $PM_{2.5}$ MEGs: Negligible MEG=15, Marginal MEG=65.

Camp Phoenix: A total of 93 valid $PM_{2.5}$ air samples were collected from January 2010 – December 2011. The range of 24-hour $PM_{2.5}$ concentrations was 34 $\mu g/m^3$ – 606 $\mu g/m^3$ with an average concentration of 106 $\mu g/m^3$.

Kabul International Airport: A total of 5 valid $PM_{2.5}$ air samples were collected from November 2011 to December 2011. The range of 24-hour $PM_{2.5}$ concentrations was 97 $\mu g/m^3$ – 351 $\mu g/m^3$ with an average concentration of 160 $\mu g/m^3$. Although the average and peak $PM_{2.5}$ concentrations were above the short-term $PM_{2.5}$ negligible MEG, data were insufficient to fully characterize the health risk associated with $PM_{2.5}$ exposure.

Camp Blackhorse: One valid $PM_{2.5}$ air sample was collected in January 2012 with a concentration of 75 $\mu g/m^3$. Although the concentration was above the short-term $PM_{2.5}$ negligible MEG, data were insufficient to fully characterize the health risk associated with $PM_{2.5}$ exposure.

Camp Julien/Dubbs: A total of 2 valid $PM_{2.5}$ air samples were collected in September 2011. The range of 24-hour $PM_{2.5}$ concentrations was 36 $\mu g/m^3$ – 108 $\mu g/m^3$ with an average concentration of 72 $\mu g/m^3$. Although the average and peak $PM_{2.5}$ concentrations were above the short-term $PM_{2.5}$ negligible MEG, data were insufficient to fully characterize the health risk associated with $PM_{2.5}$ exposure.

Camp Pol-e-Charki: One valid $PM_{2.5}$ air sample was collected in September 2011 with a concentration of 26 $\mu g/m^3$. This concentration was below the short-term $PM_{2.5}$ negligible MEG and was considered no health hazard. Data were insufficient, however, to fully characterize the health risk.

2.3.2 Short-term health risks: Camp Phoenix

Low to High: The short-term $PM_{2.5}$ health risk assessment for Camp Phoenix was low based on average $PM_{2.5}$ concentrations and the likelihood of exposure at these hazard severity levels. 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 health risk levels for $PM_{2.5}$ at Camp Phoenix showed no hazard for 40%, low health risk for 50%, moderate health risk for 5%, and high health risk for 5% of the time. Confidence in the short-term $PM_{2.5}$ health risk assessment was low (Reference 9, Table 3-6).

The short-term $PM_{2.5}$ health risk assessment at Camp Phoenix was high based on peak $PM_{2.5}$ concentrations and the likelihood of exposure at these hazard severity levels. A high health risk assessment for peak exposure concentrations suggests significant degradation of mission capabilities in terms of the required mission standard, inability to accomplish all parts of the mission, or inability to complete the mission to standard if hazards occur during the mission. Confidence in the short-term $PM_{2.5}$ health risk assessment was low (Reference 9, Table 3-6).

The hazard severity was negligible for average $PM_{2.5}$ exposures at Camp Phoenix. The results indicated that few exposed personnel (if any) were expected to have noticeable health effects during the mission. Exposed personnel were expected to be able to effectively perform all critical tasks during mission operations. Minimal to no degradation of abilities to conduct complex tasks were expected.

For the highest observed $PM_{2.5}$ exposures at Camp Phoenix, the hazard severity was critical. During peak exposures at the critical hazard severity level, most if not all personnel would experience very notable eye, nose, and throat irritation and respiratory effects. Visual acuity would be impaired, as would overall aerobic capacity. Some personnel would not be able to perform assigned duties. Lost duty days were expected. Those with a history of asthma or cardiopulmonary disease would experience more severe symptoms. Conditions may also have resulted in adverse, non-health related materiel/logistical impacts.

2.3.3 Long-term health risks: Camp Phoenix

Moderate: The long-term $PM_{2.5}$ health risk assessment for Camp Phoenix was moderate based on $PM_{2.5}$ concentrations and the likelihood of exposure at these hazard severity levels. A moderate health risk assessment for peak exposure concentrations suggests that short-term exposure to peak $PM_{2.5}$ concentrations at Camp Phoenix were expected to have degraded mission capabilities in terms of the required mission standard and would result in reduced mission capability if hazards occurred during the mission. Confidence in the short-term $PM_{2.5}$ health risk assessment was low (Reference 9, Table 3-6).

For the average observed $PM_{2.5}$ exposure on Camp Phoenix, the hazard severity was marginal. At the marginal hazard severity level many exposed persons were expected to have noticeable, but not incapacitating health effects. Observable effects required minimal, if any, medical attention, but may have reduced some individual physical capabilities and/or may have enhanced stress-related casualties. Exposed personnel were able to perform most critical tasks. Note: Ability to accomplish complex tasks may have been degraded.

2.4 Airborne Metals from PM_{10}

2.4.1 Sample data/Notes: Camp Phoenix

The health risk assessment was based on average and peak concentration of 14 valid PM_{10} airborne metal samples collected from April 2010 – December 2010, and the likelihood of exposure.

2.4.2 Short-term health risks: Camp Phoenix

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

2.4.3 Long-term health risks: Camp Phoenix

None identified based on the available sampling data.

2.5 Volatile Organic Compounds (VOC)

2.5.1 Sample data/Notes: Camp Phoenix

The health risk assessment was based on average and peak concentration of 4 valid volatile organic chemical (VOC) air samples collected from 18 January 2011 – 20 January 2011, and the likelihood of exposure. None of the analyzed VOC pollutants were found at concentrations above short or long-term MEGs. Data were insufficient, however, to fully characterize the health risk.

2.5.2 Short and long-term health risks: Camp Phoenix

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

3 Soil

3.1 Site-Specific Sources Identified

3.2 Sample data/Notes:

A total of 2 valid surface soil samples were collected from Camp Phoenix from 31 August 2010 to 01 November 2011 and 3 valid surface soil samples were collected from the US Embassy on 10 October 2011 to assess OEH health risk to deployed personnel. The primary soil contamination exposure pathways are dermal contact and dust inhalation. Typical parameters analyzed for included SVOCs, heavy metals, PCBs, pesticides, herbicides. If the contaminant was known or suspected, other parameters may have been analyzed for (i.e. total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAH) near fuel spills). The percent of the population exposed to soil and associated dust in the sampled areas was > 75% for 1 sample, 10 > 25% for 1 sample, and < 10% for 3 samples. For the risk assessment, personnel were assumed to have remained at this location for 2 weeks to 1 year. Whiles no parameters exceeded the MEGs, data were insufficient to fully characterize the risk.

3.3 Short-term health risk:

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

3.4 Long-term health risk:

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

4 Water

In order to assess the health risk to US personnel from exposure to water in theater, the APHC identified the most probable exposure pathways. These were based on the administrative information provided on the field data sheets submitted with the samples taken over the time period being evaluated. It was assumed that 100% of all U.S. personnel at all the locations would be directly exposed to Reverse Osmosis Water Purification Unit (ROWPU) treated and/or disinfected fresh bulk water, since this classification of water was primarily used for personal hygiene, showering, cooking, and for use at vehicle wash racks. The one exception being the use of untreated water for non-drinking purposes at Camp Blackhorse. Field data sheets indicated that bottled water was the only source of drinking water.

4.2 Non-Drinking Water: Treated/Disinfected

4.2.1 Site-Specific Sources Identified

Although the primary route of exposure for most microorganisms was ingestion of the potentially contaminated water, dermal exposure to some microorganisms, chemicals, and biologicals may have also caused adverse health effects. Complete exposure pathways would have included drinking, brushing teeth, personal hygiene, cooking, providing medical and dental care using a contaminated water supply or during dermal contact at vehicle or aircraft wash racks.

4.2.2 Sample data/Notes:

To assess the potential for adverse health effects to troops, the following assumptions were made: All U.S. personnel at this location were expected to remain at this site for approximately 1 year. A conservative (protective) assumption was that personnel routinely consumed less than 5 liters per day (L/day) of non-drinking water for up to 365 days (1-year). It was further assumed that control measures and/or personal protective equipment were not used. A total of 32 valid non-drinking ROWPU / treated water samples from the Kabul International Airport, US Embassy, New Kabul Compound, Camp Eggers, Camp Julien, Camp Dubbs, Camp Morehead and Camp Phoenix, and 2 valid non-drinking untreated water samples at Camp Blackhorse from 06 January 2010 to 03 January 2012 were evaluated for this health risk assessment.

4.2.3 Long-term health risks:

Low: The health risk from boron in ROWPU-treated (non-drinking) water at the Kabul International Airport was Low. Confidence in the risk assessment was low because of limited sample data.

The health risks from calcium present at all locations and potassium present at the New Kabul Compound and the US Embassy were not able to be assessed, however; levels expected to be consumed did not exceed safe maximum dietary guidelines.

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 between 1 January 2010 and 3 January 2012.

5.2 Depleted Uranium (DU)

No specific hazard sources were documented in DOEHRS or MESL data portal between 1 January 2010 and 3 January 2012.

5.3 Ionizing Radiation

No specific hazard sources were documented in DOEHRS or MESL data portal between 1 January 2010 and 3 January 2012.

5.4 Non-Ionizing Radiation

No specific hazard sources were documented in DOEHRS or MESL data portal between 1 January 2010 and 3 January 2012.

6 Endemic Disease[1]

This document lists the current endemic diseases reported in the region, its specific unmitigated risks and severity and general health information about the disease. This document was used to describe, as best as possible what diseases may have been prevalent at the time in that location. The USCENTCOM MOD 11 (Reference 11 of this document) lists deployment requirements, to include immunization and chemoprophylaxis, in effect during the time frame covered by this POEMS.

6.1 Food borne and Waterborne Diseases

Food borne and waterborne diseases in the area were potentially transmitted through the consumption of local food and water. Sanitation was poor throughout the country, including major urban areas. Local food and water sources (including ice) were 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 did not exist within the country. Only a small fraction of diseases were identified or reported in host nation personnel. Diarrheal diseases could have been expected to temporarily incapacitate a very high percentage of U.S. personnel within days if local food, water, or ice was consumed. Hepatitis A and typhoid fever could have caused prolonged illness in a smaller percentage of unvaccinated personnel. Vaccination was required for DOD personnel and contractors. In addition, although not specifically assessed in this document, viral gastroenteritis (e.g., norovirus) and food poisoning (e.g., *Bacillus cereus*, *Clostridium perfringens*, and *Staphylococcus*) may have caused significant outbreaks. Key disease risks are summarized below:

6.1.1 Diarrheal diseases (bacteriological)

High: Potential health risk to U.S. personnel was high year round. Risk was typically highest following spring floods. In general, bacterial agents such as enterotoxigenic *Escherichia coli*, *Campylobacter*, *Shigella*, and *Salmonella* were the most common causes of traveler's diarrhea wherever sanitary

[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.

conditions were significantly below U.S. standards. The health risk of cholera was considered in its own health risk assessment. An operationally significant attack rate (potentially over 50% per month) could have occurred among personnel consuming local food, water, or ice. Field conditions (including lack of hand washing and primitive sanitation) may have facilitated person-to-person spread. Typically mild disease is treated in outpatient settings; with recovery and return to duty 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 LOW: Unmitigated health risk to U.S. personnel was high year round. Mitigation was in place, US Personnel did not drink untreated Afghan water and vaccination with Hepatitis A vaccine is required for deployment into the CENTCOM AOR. Water consumed by US/DOD personnel was treated on military camps. In non-indigenous personnel, hepatitis A typically occurred after consumption of fecally contaminated food or water. Infection also may have occurred through direct fecal-oral transmission under conditions of poor hygiene and sanitation. 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 LOW: Unmitigated health risk to U.S. personnel was high year round. Mitigation measures include mandatory Typhoid vaccination for US deployers to the CENTCOM AOR. Risk was typically highest following spring floods. Typhoid and paratyphoid were potentially acquired through the consumption of fecally contaminated food or water. Asymptomatic carriers are common with typhoid and contribute to sustained transmission. A small number of cases (less than 1% per month attack rate) could have occurred among unvaccinated personnel who consumed local food, water, or ice. Common source outbreaks may have occurred. Mitigation was in place, US Personnel did not drink untreated Afghan water. Water consumed by US/DOD personnel was treated on military camps. 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: Mitigation was in place, US Personnel did not drink untreated Afghan water. Water consumed by US/DOD personnel was treated on military camps. Potential health risk to U.S. personnel was Moderate year round. Risk was typically highest following spring floods. In general, *Cryptosporidium* spp., *Entamoeba histolytica*, and *Giardia lamblia* were the most common protozoal causes of diarrhea wherever sanitary conditions are significantly below U.S. standards. A small number of cases (less than 1% per month attack rate) could have occurred among personnel consuming local food, water, or ice. Outbreaks affecting a higher percentage of personnel were possible with *Cryptosporidium*. Symptomatic cases varied 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: Potential health risk to U.S. personnel was Moderate year round. Brucellosis was a common disease in cattle, sheep, goats, swine, and some wildlife species in most developing countries. Humans may have contracted 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 are present. However, the health risk from contaminated dairy products was present countrywide, including urban areas. Rare cases (less than 0.1% per month attack rate) could have occurred among personnel consuming local dairy products or having direct contact with livestock. Mitigation was in place, US Personnel did not drink untreated Afghan water. Water consumed by US/DOD personnel was treated on military camps. 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: Mitigation was in place to reduce the residual health risk to low, US Personnel did not drink untreated Afghan water. Water consumed by US/DOD personnel was treated on military camps. Unmitigated health risk to U.S. personnel was Moderate year round. Risk was greatest during warmer months when water sources dry up and there was widespread use of open irrigation canals for domestic water. 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. Children, the elderly, or people with low gastric acidity (or those taking antacids or acid blockers) are at increased risk of developing symptoms. 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. However, official reports generally underestimate the actual levels of circulating pathogen. Rare cases (less than 0.1% per month attack rate) could have occurred 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

Moderate: Mitigation was in place to reduce the residual health risk to low, US Personnel did not drink untreated Afghan water. Water consumed by US/DOD personnel was treated on military camps. Potential health risk to U.S. personnel was Moderate year round. Risk was typically highest following spring floods. Hepatitis E occurs in 4 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 are usually highly immune from childhood exposures, immunity levels for hepatitis E are often much lower, even in areas of extremely poor sanitation. Typically, outbreaks of

hepatitis E occur primarily among adults; infections among children are less common. Although data are insufficient to assess potential disease rates, we could not rule out rates approaching 1 percent per month among personnel consuming local food, water, or ice. Rates may have exceeded 1 percent per month for personnel heavily exposed during outbreaks in the local population. Typical cases involve 1 to 3 weeks of debilitating symptoms, sometimes initially requiring inpatient care; recovery and return to duty may require a month or more. Infection with genotypes 1 or 2 during the third trimester of pregnancy is associated with a 20 percent fatality rate.

6.1.8 Short-term Health Risks:

Moderate to high: The overall short-term unmitigated risk associated with food borne and waterborne diseases was considered High (for bacterial diarrhea, hepatitis A, typhoid fever / paratyphoid fever) to Moderate (for diarrhea-protozoal, diarrhea-cholera, brucellosis, hepatitis E) if local food or water is consumed. Preventive Medicine measures such as vaccinations reduced the risk estimate to none (for Hepatitis A and Typhoid fever). Additionally, U.S. Forces were provided food and water from approved sources. Confidence in the health risk estimate was high.

6.1.9 Long-term Health Risks:

None identified based on available data.

6.2 Arthropod Vector-Borne Diseases

During the warmer months, the climate and ecological habitat supported populations of arthropod vectors, including mosquitoes, ticks, mites, and sandflies. Malaria, the major vector-borne health risk in Afghanistan, was capable of debilitating a high percentage of personnel for up to a week or more. In addition, other vector-borne diseases were transmitted at low or unknown levels and may have constituted a significant health risk in the absence of mitigation measures.

6.2.1 Malaria

Moderate: Mitigation measures included mandated chemoprophylaxis, which when used as directed reduced malaria risks to low. Potential unmitigated risk to U.S. personnel was moderate during warmer months (typically March through November). Malaria incidents were often associated with the presence of agriculture activity, including irrigation systems and standing water, which provide breeding habitats for vectors. A small number of cases could have occurred among personnel exposed to mosquito (Anopheles spp.) bites. Malaria incidents could cause debilitating febrile illness typically requiring 1 to 7 days of inpatient care, followed by return to duty. Severe cases may require intensive care or prolonged convalescence, and fatalities can occur.

6.2.2 Leishmaniasis - cutaneous

Moderate: Potential health risk to U.S. personnel was Moderate year round, but reduced to low with mitigation measures. For U.S. personnel, risk mitigation included proper wear of treated uniforms, application of repellent to exposed skin, and minimizing outdoor activities (when possible) between dusk and dawn.

Leishmaniasis is transmitted by sandflies. Transmission generally was limited to the warmer months. A small number of cases (less than 1% per month attack rate) could have occurred 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 could have been very high (over 50%). Mitigation measures that were in place include PM practices and permethrin treated uniforms. Cutaneous infection was unlikely to be debilitating, though lesions can be disfiguring. Definitive treatment previously required non-urgent evacuation to the continental United States; currently, not all cases require evacuation.

6.2.2 Leishmaniasis - visceral

Moderate: Potential health risk to U.S. personnel was Moderate year round, but reduced to low with mitigation measures. For U.S. personnel, risk mitigation included proper wear of treated uniforms, application of repellent to exposed skin, and minimizing outdoor activities (when possible) between dusk and dawn.

Leishmaniasis is transmitted by sandflies. Transmission generally was limited to the warmer months. Disease was assessed as present, but levels were unknown; rare cases were possible among personnel exposed to sandfly bites in areas with infected humans, dogs, or other reservoir animals. Asymptomatic chronic infections may have occurred, which may become symptomatic years later. In groups of personnel exposed to heavily infected sandflies in focal areas, attack rates could have been very high (over 50%). Mitigation measures that were in place included IPM practices and permethrin treated uniforms. Cutaneous infection was unlikely to be debilitating, though lesions can be disfiguring. Definitive treatment previously required non-urgent evacuation to the continental United States; currently, not all cases require evacuation.

6.2.3 Crimean-Congo hemorrhagic fever

Moderate: Potential health risk to U.S. personnel was Moderate year round with peak transmission from March through November, but reduced to low with mitigation measures. For U.S. personnel, risk mitigation included proper wear of treated uniforms and application of repellent to exposed skin. Risk from tick-borne transmission was limited primarily to warmer months. Risk of transmission from animal contact was present year-round. Most primary Crimean-Congo hemorrhagic fever (CCHF) infections 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, but may be associated with changes in agricultural land use that increase tick contact or incursions of susceptible populations into areas where the disease is endemic. Rare cases (less than 0.1% per month attack rate) could have occurred among personnel exposed to tick bites. Direct contact with blood and body fluids of an infected animal or person may also have transmitted infection. It is a very severe illness typically requiring intensive care with fatality rates from five to fifty percent.

6.2.4 Sandfly fever

Moderate: Sandfly fever had a moderate health risk, and transmission generally was limited to the warmer months. 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. Other suitable habitats include leaf litter, rubble, loose earth, caves, and rock holes. Sandflies may be common in peridomestic settings. Abandoned dwellings, sometimes used by troops as temporary quarters, also can harbor significant numbers of sandflies. Stables and poultry pens in peridomestic areas also may harbor sandflies. Although data were insufficient to assess potential disease rates, 1 to 10 percent of personnel could have been affected per month under worst case conditions. In small groups, exposed to heavily infected sandfly populations in focal areas, attack rates could have been 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.

6.2.5 Plague

Low: Potential health risk to U.S. personnel was Low year round. Bubonic plague typically occurs as sporadic cases among people who come in contact with wild rodents and their fleas during work, hunting, or camping activities. Outbreaks of human plague are rare and typically occur in crowded urban settings associated with large increases in infected commensal rats (*Rattus rattus*) and their flea populations. Some untreated cases of bubonic plague may develop into secondary pneumonic plague. Respiratory transmission of pneumonic plague is rare but has the potential to cause significant outbreaks. Close contact is usually required for transmission. In situations where respiratory transmission of plague is suspected, weaponized agent must be considered. Extremely rare cases (less than 0.01% per month attack rate) could occur. Incidence could result in potentially severe illness which may require more than 7 days of hospitalization and convalescence.

*6.2.6 Typhus-miteborne (scrub typhus**)***

Moderate: Potential health risk to U.S. personnel was Moderate during warmer months (typically March through November) when vector activity is highest. Mite-borne typhus is a significant cause of febrile illness in local populations with rural exposures in areas where the disease is endemic. Large outbreaks have occurred when non-indigenous personnel such as military forces enter areas with established local transmission. The disease is transmitted by the larval stage of trombiculid mites (chiggers), which are typically found in areas of grassy or scrubby vegetation, often in areas which have undergone clearing and regrowth. Habitats may include sandy beaches, mountain deserts, cultivated rice fields, and rain forests. Although data were insufficient to assess potential disease rates, attack rates could have been very high (over 50%) in groups of personnel exposed to heavily infected "mite islands" in focal areas. The disease can cause debilitating febrile illness typically requiring 1 to 7 days of inpatient care, followed by return to duty.

6.2.7 West Nile fever

Low: Potential health risk to U.S. personnel was Low with transmission generally limited to the warmer months. West Nile fever was present and was maintained by bird populations and multiple species of *Culex* 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.

6.2.8 Short -term health risks:

Low to High: The unmitigated health risk estimate was high for malaria (infection rate of less than 1% per month), Moderate for leishmaniasis - cutaneous (acute), Crimean-Congo hemorrhagic fever, sandfly fever, typhus-miteborne; and Low for the plague and West Nile fever. Health risk was reduced to low by proper wear of the uniform, application of repellent to exposed skin, and appropriate chemoprophylaxis. Confidence in health risk estimate was high.

6.2.9 Long -term health risks:

Moderate for the visceral [chronic] leishmaniasis. Confidence in the health risk estimate was high.

6.3 Water Contact Diseases

Operations or activities that involved extensive water contact may have resulted in personnel being temporarily debilitated with leptospirosis in some locations. Leptospirosis health risk typically increases during flooding. In addition, although not specifically assessed in this document, bodies of surface water were likely to be contaminated with human and animal waste. Activities such as wading or swimming may have resulted in exposures to enteric diseases such as diarrhea and hepatitis via incidental ingestion of water. Prolonged water contact also may have also lead to the development of a variety of potentially debilitating skin conditions such as bacterial or fungal dermatitis.

6.3.1 Leptospirosis

Moderate: Potential health risk to U.S. personnel was Moderate with transmission generally limited to the warmer months. Leptospirosis is a febrile illness with a worldwide distribution, which often goes unrecognized and unreported. Rodents, domestic livestock, and other animals are reservoirs for the causative agent (a spirochete) and shed the organism in their urine. Organisms remain viable in surface water or mud, particularly at temperatures at or above 22 °C (or 70 °F). Human infection occurs through direct contact of contaminated water or mud with abraded skin or mucous membranes. Concentrations of the organism in lakes, rivers, or other surface water may vary significantly from location to location. Transmission occurs in both rural and urban areas and may be increased during flooding. 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. Although data were insufficient to assess potential disease rates, up to 1 to 10 % of personnel wading or swimming in bodies of water such as lakes, streams, or irrigated fields could have been affected per month. In groups with prolonged exposure to heavily contaminated foci, attack rates could have been as high as up to 50 percent. Incidence can result in debilitating febrile illness typically requiring 1 to 7 days of inpatient care, followed by return to duty; some cases may require prolonged convalescence.

6.3.2 Short -term health risks:

Moderate: Health risk of leptospirosis was moderate during warmer months. Confidence in the health risk estimate was high.

6.3.3 Long -term health risks:

None identified based on available data.

6.4 Respiratory Diseases

Although not specifically assessed in this document, deployed U.S. forces may have been exposed to a wide variety of common respiratory infections in the local population. These included influenza, pertussis, viral upper respiratory infections, viral and bacterial pneumonia, and others. U.S. military populations living in close-quarter conditions were at risk for substantial person-to-person spread of respiratory pathogens. Influenza was of particular concern because of its ability to debilitate large numbers of unvaccinated personnel for several days. Requirements for service members being vaccinated against influenza mitigated this risk, however.

6.4.1 Tuberculosis (TB)

Moderate: Potential health risk to U.S. personnel was Moderate year round. Transmission typically requires close and prolonged contact with an active case of pulmonary or laryngeal tuberculosis (TB), although it also can occur with more incidental contact. The likelihood of exposure to an active case varies with the overall incidence and the degree of contact with the local population, particularly those living in conditions of crowding and poverty. Tuberculin skin test (TST) conversion rates may have been elevated over baseline for personnel with prolonged close exposure to local populations. A TST screening to detect latent infection may have been warranted in personnel with a history of prolonged close exposure to local populations. Tuberculosis exposure and infection are evaluated as part of the Post Deployment Health Assessment (PDHA) process.

6.4.2 Meningococcal meningitis

Low: Potential health risk to U.S. personnel was Low year round. However, the health risk may have been elevated during cooler months. Asymptomatic colonization and carriage of meningococcal bacteria was common worldwide, including within U.S. military populations; rare symptomatic cases may have occurred periodically in military populations, regardless of geographic location. Neisseria meningitides group A predominated regionally. Meningococcal meningitis is potentially a very severe disease typically requiring intensive care; fatalities may occur in 5-15% of cases.

6.4.3 Short-term health risks:

Moderate (tuberculosis) to **Low** (for meningococcal meningitis). Confidence in the health risk estimate was high.

6.4.4 Long-term health risks:

None identified based on available data.

6.5 Animal-Contact Diseases

6.5.1 Rabies

Moderate: Potential health risk to U.S. personnel was Moderate year round. Rabies virus infects warm-blooded animals, such as dogs, cats, bats, foxes, skunks, raccoons, mongooses, and jackals, and is transmitted through bites that break the skin, a scratch that bleeds or wet animal saliva contact with mucous membranes or broken skin. Monkeys can transmit rabies as well as Simian Herpes B virus, which causes a fatal brain infection in humans. Rats and mice very rarely transmit rabies and such exposures do not typically require rabies prophylaxis. Dogs are responsible for most rabies-risk exposures in Afghanistan and over 90% of the estimated 55,000 rabies deaths that occur annually around the world. Prevalence of rabies in feral and wildlife populations, including dogs, was well above U.S. levels due to the lack of organized control programs. Personnel bitten by potentially infected reservoir species may develop rabies if preventive treatment is not received or is significantly delayed. General Order 1B mitigated rabies risk by prohibiting the adoption of (whether as pet or mascot), caring for, or feeding any type of domestic or wild animal. Very severe illness with near 100% fatality rate could have occurred if post-exposure prophylaxis was not sought or administered in a timely manner.

A U.S. Army Soldier died of rabies on 31 August 2011 (Reference 12). Laboratory results indicated the Soldier was infected from contact with a dog while deployed in Afghanistan. During the public health investigation of this case, members of the Soldier's unit reported they had also received dog bites in Afghanistan, had not reported the bites to medical providers, and had not received rabies post-exposure prophylaxis (PEP). Medical record reviews in Afghanistan identified other individuals who presented for care but did not receive the recommended PEP. As a result of these discoveries, the Army Surgeon General ordered a public health response to identify, notify, and treat all Service Members, civilians, contractors and other personnel who had sustained rabies risk exposures during deployment. Despite the educational programs implemented as a result of these efforts, Service members who have sustained otherwise unreported and untreated potential rabies risk exposures during deployment continue to be identified on post-deployment health assessments. 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.

6.5.2 Anthrax

Low: Potential health risk to U.S. personnel was Low year round. Anthrax is a naturally occurring infection of livestock and wild herbivores with a worldwide distribution. Rare cases (less than 0.1% per month attack rate) could have occurred among personnel with occupational-type exposure to livestock or wild herbivores, hides, wool products from these species, as well as handling or consumption of undercooked meat. In the absence of such exposures, the health risk was essentially zero. Inhalation cases raise the possibility of weaponized agent. Cutaneous and gastrointestinal anthrax are the most common forms of naturally occurring anthrax. The health risk of naturally acquired inhalation (pulmonary) anthrax is remote. 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. Inhalation anthrax is very severe, often requiring intensive care; fatalities may occur even in treated cases.

6.5.3 Q-Fever

Moderate: 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%) could have occurred in personnel with heavy exposure to barnyards or other areas where animals are kept. Unpasteurized milk may also have transmitted infection. The primary route of exposure is respiratory, with an infectious dose as low as a single organism. Incidence could result in debilitating febrile illness, sometimes presenting as pneumonia, typically requiring 1 to 7 days of inpatient care followed by return to duty.

6.5.4 H5N1 avian influenza

Low: Potential health risk to U.S. personnel was Low. Although H5N1 avian influenza (AI) is easily transmitted among birds, bird-to-human transmission is extremely inefficient. Human infections have occurred on a very rare basis and have been associated with activities involving close, direct contact with infected poultry, such as plucking, slaughter, or other handling. There is no health risk from consumption of properly cooked poultry products. Human-to-human transmission appears to be exceedingly rare, even among relatively close contacts. Extremely rare cases (less than 0.01% per month attack rate) could have occurred. Incidence could have resulted in very severe illness with fatality rate higher than 50 percent in symptomatic cases.

6.5.5 Short-term health risks:

Variable (Low to Moderate): Low short-term health risk for H5N1 avian influenza and anthrax due to rare occurrence to Moderate for rabies and Q-fever. Confidence in the health risk estimate was high.

6.5.6 Long-term health risks:

Low: The long term risk for rabies was Low.

7 Venomous Animal/Insect

All information was taken directly from the Clinical Toxinology Resources web site (http://www.toxinology.com/) from the University of Adelaide, Australia. The species listed below have home ranges that overlap the location of Kabul, and may have presented a health risk if they were encountered by personnel. See Section 9 for more information about pesticides and pest control measures.

7.1 Spiders

- *Latrodectus dahlia* (widow spider): Severe envenoming possible, potentially lethal. However, venom effects are mostly minor and even significant envenoming is unlikely to be lethal.

7.2 Scorpions

- *Mesobuthus caucasicus, Mesobuthus eupeus, Mesobuthus macmahoni, Orthochirus afghanus, Orthochirus bicolor*, *Orthochirus heratensis, Orthochirus Jalalabadensis, Orthochirus pallidus, Orthochirus samrchelsis* and *Orthochirus scrobiculosus*: 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.

- *Hottentotta alticola* and *Hottentotta saulcyi*: Moderate envenoming was possible, but unlikely to prove lethal. Stings by these scorpions are likely to cause only short lived local effects, such as pain, without systemic effects.

- *Scorpiops afghanus*: 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.

7.3 Snakes

- *Boiga trigonata* (Common Cat Snake), and *Telescopus rhinopoma* (leopard viper): Unlikely to cause significant envenoming; Bites by these rear fanged Colubrid snakes are rarely reported. They are likely to cause minimal to moderate local effects and no systemic effects.

- *Gloydius halys* (Haly's Pit Viper): Severe envenoming possible, potentially lethal. Bites may cause moderate to severe coagulopathy and haemorrhagins causing extensive bleeding.

- *Hemorrhis ravergieri* (mountain racer) and *Psammophis lineolatus* (Teer snake): Unlikely to cause significant envenoming. Bites require symptomatic treatment only.

- *Macrovipera lebetina obtuse* (Levantine Viper) *and Macrovipera lebetina turanica* (Levantine Viper): Severe envenoming possible, potentially lethal. Bites may cause mild to severe local effects, shock & coagulopathy.

- *Naja oxiana* (Oxus cobra): Severe envenoming possible, potentially lethal. Bites can cause systemic effects, principally flaccid paralysis.

- *Platyceps rhodorachis* (Jan's desert racer): Mild envenoming only, not likely to prove lethal. Requires symptomatic treatment only.

7.4 Short-term health risk:

Low: If encountered, effects of venom varied with species from mild localized swelling (e.g. widow spider) to potentially lethal effects (e.g. Haly's Pit Viper). See effects of venom above. Confidence in the health risk estimate was low (Reference 9, Table 3-6).

7.5 Long-term health risk:

None identified.

8 Heat/Cold Stress

Kabul is located in the Kabul Province of eastern Afghanistan and is situated 5,900 ft above sea level in a narrow valley and along the Kabul River. It is bordered by two steep mountain ranges. It has a semi-arid, continental climate with precipitation concentrated in the winter (sometimes falling as snow) and spring months. Summers are long and hot (temperatures range up to 90°F) but have very low humidity. Autumn, in October and November, is warm and dry. Winters are cold but short, lasting from December to March (temperature range: 19-40°F). Spring in Kabul starts in late March and is the wettest time of the year (average rainfall for March is 3 inches).

8.1 Heat

Average daily peak temperature during the summer months (June – September) is 72°F with an average monthly peak temperature of 87°F. The health risk of heat stress/injury based on temperatures alone is Low (< 78 °F) from October – May, High (82-87.9°F) in June and September and extremely high (≥ 88°F) from July-August. However, work intensity and clothing/equipment worn pose greater health risk of heat stress/injury than environmental factors alone (Reference 6, 2001).

8.1.1 Short-term health risk:

Low to High: High health risk of heat injury in unacclimatized personnel in July and August, and Low from June – September. The risk of heat injury was reduced through preventive measures. Because the occurrence of heat stress/injury is strongly dependent on operational factors (work intensity and clothing), confidence in the health risk estimate was low (Reference 9, Table 3-6).

8.1.2 Long-term health risk:

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 was Low; confidence in the health risk estimates was medium (Reference 9, 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 November – March. 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 health risk of cold injury is Low. Confidence in the health risk estimate is medium.

8.1.2 Long-term health risk:

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

9 Noise

9.1 Continuous

Preventive Medicine Base Camp Assessments from every camp evaluated in this document indicate that noise was not an issue at any of the camps.

9.1.1 Short-term and Long-term health risks:

Low: short-term health risk of noise injury with appropriate hearing protection use is Low. Confidence in the health risk assessment is medium (Reference 9, Table 3-6).

9.2 Impulse

9.2.1 Short-term and Long-term health risks:

Not evaluated. No data available.

10 Unique Incidents/Concerns

10.1 Potential environmental contamination sources

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

10.2 Pesticides/Pest Control:

The health risk of exposure to pesticide residues is considered within the framework of typical residential exposure scenarios, based on the types of equipment, techniques, and pesticide products that have been employed, such as enclosed bait stations for rodenticides, various handheld equipment for spot treatments of insecticides and herbicides, and a number of ready-to-use (RTU) methods such as aerosol cans and baits. The control of rodents required the majority of pest management inputs, with the acutely toxic rodenticides staged as solid formulation lethal baits placed in tamper-resistant bait stations indoors and outdoors throughout cantonment areas. Nuisance insects, including biting and stinging insects such as bees, wasps, and ants, also required significant pest management inputs. Use of pesticides targeting against these pests generally involved selection of compounds with low mammalian toxicity and short-term residual using pinpoint rather than broadcast application techniques. A total of 8 monthly pesticide application reports in the MESL data portal for Camp Eggers (between January 2009 and February 2010) and 8 reports from Camp Phoenix (between January 2009 and January 2010) 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.

10.2.1 Rodenticides

From the pesticide usage reports, both Bromadiolone and Brodifacoum were used to control rodents.

10.2.2 Insecticides

Insecticides used to control ants, bees, crickets, fleas, flies, lice, mosquitoes, spiders, termites, and wasps include: Pyrethrins, Piperonyl Butoxide, ß-Cyfluthrin, Imidacloprid, Z- 9- Tricosene, Fipronil, Hydramethylnon, Lambda-cyhalothrin and deltamethrin.

10.2.3 Short-term and Long-term health risks

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

10.3 Burn Pit

While not specific to Camp Phoenix, the consolidated epidemiological and environmental health sampling studies on burn pits that have been conducted to date were unable to say whether an association does or does not exist between exposures to emissions from the burn pits and long-term health effects (Reference 7, 2011). 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) might be associated with long-term health effects, particularly in susceptible (e.g., those who have asthma) or highly exposed subpopulations (such as those who worked at the burn pit). Such health effects would be due mainly to high ambient concentrations of PM from both natural and anthropogenic sources, including military sources. If that broader exposure to air pollution turns out to be relevant, potentially related health effects of concern are respiratory and cardiovascular effects and cancer. Susceptibility to the PM health effects could be exacerbated by other exposures, such as stress, smoking, local climatic conditions, and co-exposures to other chemicals that affect the same biologic or chemical processes. Individually, the chemicals measured at burn pit sites in the study were generally below concentrations of health concern for general populations in the United States. However, the possibility of exposure to mixtures of the chemicals raises the potential for health outcomes associated with cumulative exposure to combinations of the constituents of burn pit emissions and emissions from other sources.

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

10.7.1.1 Sample data/Notes:

Exposure Guidelines:
Short-term (24-hour) PM_{10} ($\mu g/m^3$): Negligible MEG=250, Marginal MEG=420, Critical MEG=600
Long-term PM_{10} MEG ($\mu g/m^3$): Not Available.

A total of 2 valid PM_{10} air samples were collected from the Camp Phoenix burn pit area from April 2010 to May 2010. The range of 24-hour PM_{10} concentrations was 188 $\mu g/m^3$ – 977 $\mu g/m^3$ with an average concentration of 583 $\mu g/m^3$. Although the average and peak PM_{10} concentrations were above the short-term PM_{10} negligible MEG, data were insufficient to fully characterize health risk associated with PM_{10} exposure.

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

10.7.2.1 Sample data/Notes:

Exposure Guidelines:
Short-term (24-hour) $PM_{2.5}$ MEGs ($\mu g/m^3$): Negligible MEG=65, Marginal MEG=250, Critical MEG=500.
Long-term $PM_{2.5}$ MEGs: Negligible MEG=15, Marginal MEG=65.

A total of 20 valid $PM_{2.5}$ air samples were collected from the Camp Phoenix burn pit area from March 2010 to July 2011. The range of 24-hour $PM_{2.5}$ concentrations was 43 $\mu g/m^3$ – 563 $\mu g/m^3$ with an average concentration of 127 $\mu g/m^3$.

10.7.2.2 Short-term health risks

Low: The short-term $PM_{2.5}$ health risk assessment for the Camp Phoenix burn pit was Low based on average $PM_{2.5}$ concentrations, and the likelihood of exposure at these hazard severity levels. 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 health risk levels

for $PM_{2.5}$ at the burn pit show no hazard for 40%, low health risk for 50%, moderate health risk for 5%, and high health risk for 5% of the time. Confidence in the short-term $PM_{2.5}$ health risk assessment was low (Reference 9, Table 3-6).

The short-term $PM_{2.5}$ health risk assessment at the burn pit was Low based on peak $PM_{2.5}$ concentrations, and the likelihood of exposure at these hazard severity levels. A Low health risk assessment for typical exposure concentrations suggests that short-term exposure to $PM_{2.5}$ at the burn pit was expected to have little or no impact on accomplishing the mission.

The hazard severity was negligible for average $PM_{2.5}$ exposures at the burn pit. The results indicate that few exposed personnel (if any) are expected to have noticeable health effects during mission. Exposed personnel are expected to be able to effectively perform all critical tasks during mission operations. Minimal to no degradation of abilities to conduct complex tasks are expected.

For the highest observed $PM_{2.5}$ exposures at the burn pit, the hazard severity was critical. During peak exposures at the critical hazard severity level, most if not all personnel experience very notable eye, nose, and throat irritation and respiratory effects. Visual acuity is impaired, as is overall aerobic capacity. Some personnel will not be able to perform assigned duties. Lost duty days are expected. Those with a history of asthma or cardiopulmonary disease will experience more severe symptoms. Conditions may also result in adverse, non-health related materiel/logistical impacts.

10.7.2.2 Long-term health risks

Low: The long-term $PM_{2.5}$ health risk assessment for the burn pit was Low based on average $PM_{2.5}$ concentrations and the likelihood of exposure at these hazard severity levels. A Low health risk assessment for typical exposure concentrations suggests that long-term exposure to $PM_{2.5}$ at Kabul was expected to have little or no impact on accomplishing the mission. Confidence in the long-term $PM_{2.5}$ health risk assessment was low (Reference 9, Table 3-6).

For the average observed $PM_{2.5}$ exposure at the burn pit, the hazard severity was marginal. At the marginal hazard severity level many exposed persons are expected to have noticeable, but not incapacitating health effects. Observable effects require minimal, if any, medical attention but may reduce some individual physical capabilities and/or may enhance stress-related casualties. Exposed personnel are able to perform most critical tasks. Note: Ability to accomplish complex tasks may be degraded.

11 References[2]

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

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

3. Defense Occupational and Environmental Health Readiness System (referred to as the DOEHRS-EH database) at https://doehrs-ih.csd.disa.mil/Doehrs/. Department of Defense (DoD) Instruction 6490.03, *Deployment Health*, 2006.

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

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

6. Goldman RF. 2001. Introduction to heat-related problems in military operations. *In*: Textbook of military medicine: medical aspects of harsh environments Vol. 1, Pandolf KB, and Burr RE (Eds.), Office of the Surgeon General, Department of the Army, Washington DC.

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

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

9. USAPHC Technical Guide 230, June 2010 Revision.

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

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

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

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

12 Where Do I Get More Information?

If a provider feels that the Service member's or Veteran's current medical condition may be attributed to specific OEH exposures at this deployment location, he/she can contact the Service-specific organization below. Organizations external to DoD should contact DoD Force Health Protection and Readiness (FHP & R).
Army Institute of Public Health Phone: (800) 222-9698. http://phc.amedd.army.mil/
Navy and Marine Corps Public Health Center (NMCPHC) (formerly NEHC) Phone: (757) 953-0700. http://www-nehc.med.navy.mil
U.S. Air Force School of Aerospace Medicine (USAFSAM) (formerly AFIOH) Phone: (888) 232-3764. http://www.wpafb.af.mil/afrl/711hpw/usafsam.asp
DoD Force Health Protection and Readiness (FHP & R) Phone: (800) 497-6261. http://fhp.osd.mil