Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS): Herat and vicinity, Afghanistan
Calendar Year: (2016)

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) 0017-12 (References 1-3).

PURPOSE: This POEMS documents the Department of Defense (DoD) assessment of occupational and environmental health (OEH) risk for Herat and vicinity, Afghanistan that includes Combat Outpost (COP) Metro, COP Qadis, and COP Ricketts; Camp Arena/Forward Support Battalion (FSB) Herat (Gilbert), Camp Bazaar Khona (COP Reaper, Bashar Khona), Camp Zafar, Camp Chasma-e-Dozakh, Camp Chapchal, Camp Cougar, Camp Darrah I Bum, Camp Delorean, Camp Henderson, Camp Injil, Camp Islam Qala, Camp Lawton, Camp Qal-e-Naw, Camp Parmakan, Camp Robat Sangi (Robat), Camp Sanowghan (Safe Home), Camp Shouz, Camp Thomas; Forward Operating Base (FOB) Adraskan, FOB Shindand Airbase (Shaf, Napier), FOB Stone, and FOB Todd / BMG (Bala Morghab) Herat Provincial Reconstruction Team (PRT); and Patrol Base (PB) Red Leg. It presents a qualitative summary of health risks identified at this location and their potential medical implications. The report is based on information collected from 1 January 2016 through 31 December 2016 to include deployment OEHS sampling and monitoring data (e.g., air, water, and soil), field investigation and health assessment reports, as well as country and area-specific information on endemic diseases.

This assessment assumes that environmental sampling at Herat 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 1 January 2016 through 31 December 2016.

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

SITE DESCRIPTION:

Base camps included in FSB Herat and vicinity are located in Herat and Badghis provinces of western Afghanistan. The provinces are bordered with Iran and Turkmenistan to the west. Herat Province is relatively flat except in the east along the Hindu Kush mountain range. The province is traversed from east to west by the Hari-Rud River, along which most of the people live in agricultural oases. Badghis Province is bordered by Herat Province to the southwest. Badghis Province is dominated by isolated hills and the Murghab River. Badghis Province remains extremely underdeveloped, especially outside the provincial capital of Qalay-E-Naw.

Base Camp Arena sits on high desert terrain with mountain ranges close to Herat City. The camp soil is rocky; however, most of the roads are paved. The Camp consists of two compounds, the Italian and American, and are sometimes referred to as U.S. Forces-Afghanistan (USFOR-A) and Logistic Support

Activities (LSA). Each camp contains facilities for office space and billeting. The Italian camp has an estimated population of 850, and the American camp has approximately 100 personnel (Reference 4).

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 Herat 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.

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

Short-term health risks & medical implications:

The following hazards may be associated with potential acute health effects in some personnel during deployment at Herat and vicinity:

Food/waterborne diseases (e.g., bacterial diarrhea, hepatitis A, typhoid/paratyphoid fever, diarrhea-cholera, diarrhea-protozoal, brucellosis, hepatitis E); other endemic diseases (cutaneous leishmaniasis (acute), Crimean-Congo hemorrhagic fever, sandfly fever, scrub typhus (mite-borne), leptospirosis, Tuberculosis (TB), rabies, Q fever, soil transmitted helminthes (hookworm, strongyloidiasis, cutaneous larva migrans)); and heat stress. For food/waterborne diseases (e.g., bacterial diarrhea, hepatitis A, typhoid/paratyphoid fever, diarrhea-cholera, diarrhea-protozoal, brucellosis, hepatitis E), if ingesting local food and water, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (hepatitis A, typhoid/paratyphoid fever, brucellosis, hepatitis E). Risks from food/waterborne diseases may have been reduced with preventive medicine controls and mitigation, which includes hepatitis A and typhoid fever vaccinations and only drinking from approved water sources in accordance with standing CENTCOM policy. For other vector-borne endemic diseases (cutaneous leishmaniasis (acute), Crimean-Congo hemorrhagic fever, sandfly fever, scrub typhus (mite-borne)), 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, bed net use, and appropriate chemoprophylaxis, as well as minimizing areas of standing water and other vector-breeding areas. For water contact diseases (leptospirosis), 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 soil transmitted helminthes (hookworm, strongyloidiasis, cutaneous larva migrans), risk may have been reduced by limiting exposure to soil contaminated with human or animal feces (including not sleeping on bare ground, and not walking barefoot). 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, and those under operational constraints (equipment, PPE, vehicles). Risks from heat stress may have been reduced with preventive medicine controls, work-rest cycles, proper hydration and nutrition, and mitigation.

Air quality: For inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}) from environmental dust. The PM_{10} overall short-term health risk was not evaluated due no data for analysis. For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) from environmental dust, the $PM_{2.5}$ overall short-term health risk was not evaluated due insufficient data for analysis. However, the Herat and vicinity area is a dust-prone desert environment, with a semi-arid climate, also subject to vehicle traffic. Consequently, exposures to PM_{10} and $PM_{2.5}$ may vary, as conditions may vary, and 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. The only burn pit that was identified was the Herat City burn pit located approximately 10km west of Camp Arena. No other burn pits were identified.
Other burn pits and/or incinerators might have existed at Herat and vicinity (for example, burn pits used by the local population). However, there were no sampling data of burn pits available for analysis. Consequently, the PM_{10} and the $PM_{2.5}$ overall short-term health risks specifically for burn pits were not evaluated – see Section 10.7. Where burn pits exist, exposures may vary, and exposures to high levels of PM_{10} and $PM_{2.5}$ from smoke may 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. 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 while at Herat and vicinity. Personnel who reported with symptoms or required treatment while at site(s) with burn pit activity 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 hazards may be associated with potential chronic health effects in some personnel during deployment at Herat and vicinity:

Air quality: For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) from environmental dust, the overall long-term health risk was not evaluated due insufficient data for analysis. Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}) from environmental dust was not evaluated for long-term health risk due to no data for analysis and no available health guidelines. However, the Herat and vicinity area is a dust-prone desert environment, with a semi-arid climate, also subject to vehicle traffic, and conditions may have varied. The only burn pit that was identified was the Herat City burn pit located approximately 10km west of Camp Arena. No other burn pits were identified. Other burn pits and/or incinerators might have existed at Herat and vicinity (for example, burn pits used by the local population). However, there were no sampling data of burn pits available for analysis. Consequently, the PM_{10} and the $PM_{2.5}$ overall long-term health risks specifically for burn pits were not evaluated – see Section 10.7. However, burn pit exposures may vary, as conditions may have varied. For inhalational exposure to high levels of dust containing PM_{10} and $PM_{2.5}$, such as

during high winds or dust storms, and for exposures 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/barrels, 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 - Herat and vicinity

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: No data were available for analysis to characterize short-term health risk. Daily levels vary and acute health effects (e.g., upper respiratory tract irritation) are more pronounced during days with elevated PM levels. More serious effects are possible in susceptible persons (e.g., those with asthma/pre-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: No data were available for analysis to characterize short-term health risk. Daily levels vary and acute health effects (e.g., upper respiratory tract irritation) are more pronounced during days with elevated PM levels. More serious effects are possible in susceptible persons (e.g., those with asthma/pre-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: Not enough data were available for analysis to characterize health risk. Because Herat and vicinity is situated in a dusty semi-arid desert environment, a majority of the time mild acute (short term) health effects are anticipated. Elevated levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.	Limiting strenuous physical activities when air quality is especially poor; and taking actions such as closing tent flaps, windows, and doors.	Short-term: Not enough data were available for analysis to characterize health risk. Because Herat and vicinity is situated in a dusty semi-arid desert environment, a majority of the time mild acute (short term) health effects are anticipated. Elevated levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.
	Long-term: Not enough data were available for analysis to characterize health risk. A small percentage of personnel may be at increased risk for developing chronic conditions, particularly those more susceptible to acute effects (e.g., those with asthma/pre-existing respiratory diseases).		Long-term: Not enough data were available for analysis to characterize health risk. A small percentage of personnel may be at increased risk for developing chronic conditions, particularly those more susceptible to acute effects (e.g., those with asthma/pre-existing respiratory diseases).
Military Unique			
Ionizing Radiation	Short-term: Low. There is a hospital grade x-ray machine that utilizes Hydrogen-3 (tritium). Exposure is limited to those who require x-rays and personnel who operate the equipment. If calibration and maintenance is properly performed, exposure is minimal.	Properly performed calibration and maintenance reduces exposure.	Short-term: Low. There is a hospital grade x-ray machine that utilizes Hydrogen-3 (tritium). Exposure is limited to those who require x-rays and personnel who operate the equipment. If calibration and maintenance is properly performed, exposure is minimal.
	Long-term: Low. There is a hospital grade x-ray machine that utilizes Hydrogen-3 (tritium). Exposure is limited to those who require x-rays and personnel who operate the equipment. If calibration and maintenance is properly performed, exposure is minimal.		Long-term: Low. There is a hospital grade x-ray machine that utilizes Hydrogen-3 (tritium). Exposure is limited to those who require x-rays and personnel who operate the equipment. If calibration and maintenance is properly performed, exposure is minimal.
Non-ionizing Radiation	Short-term: Low. There is a Satellite Communication System (SATCOM) and a satellite communication dish as close as 10 meters from personnel.		Short-term: Low. There is a Satellite Communication System (SATCOM) and a satellite communication dish as close as 10 meters from personnel.
	Long-term: Low. There is a Satellite Communication System (SATCOM)		Long-term: Low. There is a Satellite Communication System (SATCOM)

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
	and a satellite communication dish as close as 10 meters from personnel.		and a satellite communication dish as close as 10 meters from personnel.
ENDEMIC DISEASE			
Foodborne/ Waterborne (e.g., diarrhea-bacteriological)	Short-term: Variable; High (bacterial diarrhea, hepatitis A, typhoid fever) to Moderate (diarrhea-cholera, diarrhea-protozoal, brucellosis, hepatitis E) to Low (polio) if ingesting local food/water, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (hepatitis A, typhoid fever, hepatitis E, brucellosis).	Preventive measures include Hepatitis A and typhoid fever vaccination and consumption of food and water only from approved sources.	Short-term: Low to none
	Long-term: none identified		Long-term: No data available
Arthropod Vector Borne	Short-term: Variable; Moderate for leishmaniasis - cutaneous (acute), sandfly fever, typhus-miteborne (scrub typhus); High for Crimean-Congo hemorrhagic fever and Low for, the plague, malaria and West Nile fever.	Preventive measures include proper wear of treated uniform, application of repellent to exposed skin, bed net use, minimizing areas of standing water and appropriate chemoprophylaxis.	Short-term: Low
	Long-term: Low for Leishmaniasis-visceral infection.		Long-term: No data available
Water-Contact (e.g., wading, swimming)	Short-term: Moderate for leptospirosis	Recreational swimming in surface waters not likely in this area of Afghanistan during this time period.	Short-term: Low for leptospirosis.
	Long-term: No data available		Long-term: No data available
Respiratory	Short-term: Variable; Moderate for tuberculosis (TB) to Low for meningococcal meningitis and Middle East respiratory syndrome coronavirus (MERS-CoV).	Providing adequate living and work space; medical screening.	Short-term: Low
	Long-term: No data available		Long-term: No data available
Animal Contact	Short-term: Variable; Moderate for rabies, Q-fever to Low for anthrax, and avian influenza.	Prohibiting contact with, adoption, or feeding of feral animals IAW U.S. Central Command (CENTCOM) General Order (GO) 1C. Risks are further reduced in the event of assessed contact by prompt post-exposure rabies prophylaxis IAW The Center for Disease Control's (CDC) Advisory Committee on Immunization Practices guidance.	Short-term: No data available
	Long-term: Low (Rabies)		Long-term: No data available
Soil-transmitted	Short-term: Moderate for soil transmitted helminthes (hookworm, strongyloidiasis, cutaneous larva migrans).	Risk was reduced to Low by limiting exposure to soil contaminated with human or animal feces (including sleeping on bare ground, and walking barefoot).	Short-term: Low
	Long-term: No data available		Long-term: No data available
VENOMOUS ANIMAL/			

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
INSECTS			
Snakes, scorpions, and spiders	Short-term: Low; If encountered, effects of venom vary with species from mild localized swelling (e.g., *widow spider*) to potentially lethal effects (e.g., *Haly's pit viper*).	Risk reduced by avoiding contact, proper wear of uniform (especially footwear), and proper and timely treatment.	Short-term: Low; If encountered, effects of venom vary with species from mild localized swelling (e.g., *Scorpiops lindbergi*) to potentially lethal effects (e.g., *Gloydius halys*).
	Long-term: No data available		Long-term: No data available
HEAT/COLD STRESS			
Heat	Short-term: Variable; Mitigated to Low with preventive measures.	Work-rest cycles, proper hydration and nutrition, and Wet Bulb Globe Temperature (WBGT) monitoring.	Short-term: Variable; Mitigated to Low with preventive measures.
	Long-term: No health guidelines.		Long-term: No health guidelines.
Cold	Short-term: Low risk of cold stress/injury.	Risks from cold stress reduced with protective measures such as use of the buddy system, limiting exposure during cold weather, 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 are rare but can occur, especially from more serious injuries such as frost bite.		Long-term: Low; Long-term health implications from cold injuries are rare but can occur, especially from more serious injuries such as frost bite.
NOISE			
Continuous (Flightline, Power Production)	Short-term: Insufficient data to characterize risk. Generators and an airfield were a source of noise at Camp Arena.	Hearing protection used by personnel in higher risk areas	Short-term: Insufficient data to characterize risk. Generators and an airfield were a source of noise at Camp Arena.
	Long-term: Insufficient data to characterize risk.		Long-term: Insufficient data to characterize risk.
Unique Incidents/ Concerns			
Burn Pits	Short-term: The only burn pit that was identified was the Herat City burn pit located approximately 10km west of Camp Arena. No other burn pits were identified. Other burn pits and/or incinerators might have existed at Herat and vicinity (for example, burn pits used by the local population). However, there were no sampling data of burn pits available for analysis. Consequently, the PM_{10} and the $PM_{2.5}$ overall short-term health risks specifically for burn pits were not evaluated – see Section 10.7. Exposure to burn pit smoke is variable. Exposure to high levels of PM_{10} and $PM_{2.5}$ from smoke may 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.	Risks reduced by limiting strenuous physical activities when air quality was especially poor; and action such as closing tent flaps, windows, and doors. Other control measures included locating burn pits downwind of camps, increased distance from troop populations, and improved waste segregation and management techniques.	Short-term: The only burn pit that was identified was the Herat City burn pit located approximately 10km west of Camp Arena. No other burn pits were identified. Other burn pits and/or incinerators might have existed at Herat and vicinity (for example, burn pits used by the local population). However, there were no sampling data of burn pits available for analysis. Consequently, the PM_{10} and the $PM_{2.5}$ overall short-term health risks specifically for burn pits were not evaluated – see Section 10.7. Exposure to burn pit smoke is variable. Exposure to high levels of PM_{10} and $PM_{2.5}$ from smoke may 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.
	Long-term: The only burn pit that was identified was the Herat City burn pit located approximately 10km west of		Long-term: The only burn pit that was identified was the Herat City burn pit located approximately 10km west of

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
	Camp Arena. No other burn pits were identified. Other burn pits and/or incinerators might have existed at Herat and vicinity (for example, burn pits used by the local population). However, there were no sampling data of burn pits available for analysis and health based guidelines were not available. Consequently, the PM_{10} and the $PM_{2.5}$ overall long-term health risks specifically for burn pits were not evaluated – see Section 10.7. Exposure to burn pit smoke is variable. Exposure to high levels of PM_{10} and $PM_{2.5}$ in the smoke may be associated with some otherwise healthy personnel, who were exposed for a long-term period, possibly developing 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.		Camp Arena. No other burn pits were identified. Other burn pits and/or incinerators might have existed at Herat and vicinity (for example, burn pits used by the local population). However, there were no sampling data of burn pits available for analysis and health based guidelines were not available. Consequently, the PM_{10} and the $PM_{2.5}$ overall long-term health risks specifically for burn pits were not evaluated – see Section 10.7. Exposure to burn pit smoke is variable. Exposure to high levels of PM_{10} and $PM_{2.5}$ in the smoke may be associated with some otherwise healthy personnel, who were exposed for a long-term period, possibly developing 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.

[1]This Summary Table provides a qualitative estimate of population-based short- and long-term health risks associated with the occupational environment conditions at Herat and vicinity, Afghanistan. It does not represent an individual exposure profile. Actual individual exposures and health effects depend on many variables. For example, while a chemical may have been present in the environment, if a person did not inhale, ingest, or 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 result in a significant individual exposure. Any such person seeking medical care should have their specific exposure documented in an SF600.

[2] This assessment is based on specific environmental sampling data and reports obtained from 1 January 2016 through 31 December 2016. 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 Herat and vicinity. The health risks are presented as Low, Moderate, High or Extremely High for both acute and chronic 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 Army Public Health Center (APHC). Where applicable, "None Identified" is used when though a potential exposure is identified, and no health risks of either a specific acute or chronic health effects are determined. More detailed descriptions of OEH exposures that are evaluated but determined to pose no health risk are discussed in the following sections of this report.

[4]Health risks in this Summary Table are based on quantitative surveillance thresholds (e.g., endemic disease rates; host/vector/pathogen surveillance) or screening levels, e.g., Military Exposure Guidelines (MEGs) for chemicals. Some previous assessment reports may provide slightly inconsistent health risk estimates because quantitative criteria such as MEGs may have changed since the samples were originally evaluated and/or because this assessment makes use of all historic site data while previous reports may have only been based on a select few samples.

1 Discussion of Health Risks at Herat and vicinity, Afghanistan 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 Center (USAPHC) Technical Guide 230, *Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel* (Reference 5). 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

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

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 PM_{10}

2.3.1 Exposure Guidelines:

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

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

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

- Not defined and not available.

2.3.2 Sample data/Notes:

No PM_{10} air samples were collected in Herat and vicinity in 2016.

2.3.3 Short-term health risks:

No data was available to evaluate a short term health risk.

2.3.4 Long-term health risk:

Not Evaluated-no sampling data and no available health guidelines. The U.S. Environmental Protection Agency (EPA) has retracted its long-term standard (National Ambient Air Quality Standards, NAAQS) for PM_{10} due to an inability to clearly link chronic health effects with chronic PM_{10} exposure levels.

2.4 $PM_{2.5}$

2.4.1 Exposure Guidelines:

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

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

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

- Negligible MEG = 15
- Marginal MEG = 65.

2.4.2 Sample data/Notes:

A total of three valid $PM_{2.5}$ air samples were collected in 2016 from Herat and vicinity. All three valid samples were collected at Camp Arena. The range of 24-hour $PM_{2.5}$ concentrations was 40 µg/m^3 – 451 µg/m^3 with an average concentration of 178 µg/m^3.

2.4.3 Short-term health risks:

Not enough data were available to evaluate a short term health risk.

2.4.4 Long-term health risks:

Not enough data were available to evaluate a long term health risk.

2.5 Airborne Metals

2.5.1 Sample data/Notes:

A total of three valid $PM_{2.5}$ airborne metal samples were collected at Herat and vicinity in 2016. One sample was taken near the road at the U.S. Transient Billeting, one in the work areas and one at the American Logistics Support Area. Lead and zinc were the only analyzed metals detected and all concentrations were below the 1 year negligible MEG.

2.5.2 Short-term health risks:

Not enough data were available to evaluate a short term health risk.

2.5.3 Long-term health risks:

Not enough data were available to evaluate a long term health risk.

2.6 Volatile Organic Compounds (VOC)

2.6.1 Sample data/Notes:

No VOC air samples are available for Herat and vicinity in 2016.

2.6.2 Short and long-term health risks:

Data was not available to evaluate health risks.

3 Soil

3.1 Site-Specific Sources Identified

3.2 Sample data/Notes:

No soil samples were available in Herat and vicinity in 2016.

3.3 Short-term health risk:

Data was not available to evaluate a short term health risk.

3.4 Long-term health risk:

Data was not available to evaluate a long term health risk.

4 Water

In order to assess the health risk to U.S. personnel from exposure to water in theater, the APHC identified the most probable exposure pathways. These are based on the administrative information provided on the field data sheets submitted with the samples taken over the time period being evaluated. Water samples for Herat and vicinity were not available in 2016.

4.1 Drinking Water: Bottled or Packaged Water

4.1.1 Site-Specific Sources Identified

Camp Arena: Bottled water brands which are VETCOM approved were used as the primary drinking water.

4.1.2 Sample data/Notes:

Drinking water samples were not available for Herat and vicinity in 2016.

4.1.3 Short-term and long-term health risk:

No data was available to evaluate health risks.

4.2 Non-Drinking Water: Disinfected

4.2.1 Site-Specific Sources Identified

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

At Camp Arena water was controlled by the Italians. Potable water produced at Arena on the Italian side was used for personal hygiene and sanitation only. The non-potable water from the Spanish well (Old Russian Well, Italian compound) was used for vehicle maintenance, dust abatement, and by the fire department. Local contractors distributed water to various water tanks throughout Arena. The Role II Hospital and latrines had a piping system that came from the main wells. For other parts of the camp, water was distributed by trucks driven by local contractors. Water was tested in latrines and the Role II Hospital for chlorine and once per week for coliform bacteria. All water that was tested was used for showering only. Water was tested in the Role II by preventive maintenance personnel when Camp Arena was visited. The Italian Veterinary Services tested the water at wells on a daily basis in addition to the chlorination of water done on a daily basis. The cisterns were alternated to provide water every four hours to guarantee the chlorine levels were optimal and water was fresh. The Italians added more chlorine if needed to any of the four wells.

4.2.2 Sample data/Notes:

Non-drinking water samples were not collected from Herat and vicinity in 2016.

4.2.3 Short and long-term health risks:

No data was available to evaluate health risks.

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) during the 1 January 2016 to 31 December 2016 timeframe (Reference 1).

5.2 Depleted Uranium

No specific hazard sources were documented in the DOEHRS during the 1 January 2016 to 31 December 2016 timeframe (Reference 1).

5.3 Ionizing Radiation

Camp Arena has a hospital grade x-ray machine which utilizes hydrogen-3 (tritium). Only patients and those personnel who operate the x-ray machine have the potential to be exposed. Calibration and maintenance is performed regularly on the equipment which limits radiation exposure. (Reference 4)

5.4 Non-Ionizing Radiation

No specific hazard sources were documented in the DOEHRS during the 1 January 2016 to 31 December 2016 timeframe (Reference 1).

6 Endemic Diseases

This document lists the endemic diseases reported in the region, its specific health risks and severity and general health information about the diseases. CENTCOM Modification (MOD) 12 (Reference 6) lists deployment requirements, to include immunizations and chemoprophylaxis, in effect during the timeframe of this POEMS.

6.1 Foodborne and Waterborne Diseases

Foodborne 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 disease surveillance has been improved to cover the majority of the country since 2009. There is still underreporting of specific disease incidence. 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: Diarrheal diseases are expected to temporarily incapacitate a very high percentage of personnel (potentially over 50 percent per month) within days if local food, water, or ice is consumed. Field conditions (including lack of hand washing and primitive sanitation) may facilitate person-to-person spread and epidemics. Typically mild disease treated in outpatient setting; recovery and return to duty in less than 72 hours with appropriate therapy. A small proportion of infections may require greater than 72 hours limited duty, or hospitalization.

6.1.2 Hepatitis A, typhoid/paratyphoid fever, and diarrhea-protozoal

High, mitigated to Low: Unmitigated health risk to U.S. personnel is High year round for hepatitis A and typhoid/paratyphoid fever, and Moderate for diarrhea-protozoal. Mitigation was in place to reduce the risks to low. Hepatitis A, typhoid/paratyphoid fever, and diarrhea-protozoal disease may cause prolonged illness in a small percentage of personnel (less than 1 percent per month). Although much rarer, other potential diseases in this area that are also considered a Moderate risk include: hepatitis E, diarrhea-cholera, and brucellosis.

6.1.3 Polio

Low: Potential health risk to U.S. personnel is Low. Despite a concerted global eradication campaign, poliovirus continues to affect children and adults in Afghanistan. Polio is a highly infectious disease that invades the nervous system. The virus is transmitted by person-to-person, typically by hands, food

or water contaminated with fecal matter or through direct contact with the infected person's saliva. An infected person may spread the virus to others immediately before and about one to two weeks after symptoms appear. The virus can live in an infected person's feces for many weeks. About 90 percent of people infected have no symptoms, and about one percent have a very severe illness leading to muscle weakness, difficulty breathing, paralysis, and sometimes death. People who do not have symptoms can still pass the virus to others and make them sick.

6.1.4 Short-term Health Risks:

Low: The overall unmitigated short-term risk associated with foodborne and waterborne diseases are considered High (bacterial diarrhea, hepatitis A, typhoid/paratyphoid fever) to Moderate (diarrhea-cholera, diarrhea-protozoal, brucellosis, hepatitis E) to Low (polio) if local food or water is consumed. Preventive Medicine measures reduced the risk to Low. Confidence in the health risk estimate is high.

6.1.5 Long-term Health Risks:

None identified based on available data.

6.2 Arthropod Vector-Borne Diseases

During the warmer months, the climate and ecological habitat support populations of arthropod vectors, including mosquitoes, ticks, mites, and sandflies. Significant disease transmission is sustained countrywide, including urban areas. Malaria, the major vector-borne health risk in Afghanistan, is capable of debilitating a high percentage of personnel for up to a week or more. 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

Low: Herat and vicinity have Low risk of malaria, especially in the city. A small number of cases (less than one percent per month) could occur. Transmission is generally limited to the warmer months but cases are reduced with mitigation measures. Higher elevations have shorter transmission seasons. Malaria incidents are 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 may occur among personnel exposed to mosquito (Anopheles spp) bites. Malaria incidents may cause debilitating febrile illness typically requiring one to seven days of inpatient care, followed by return to duty. Severe cases may require intensive care or prolonged convalescence.

6.2.2 Leishmaniasis

Moderate, mitigated to Low: The disease risk is Moderate during the warmer months when sandflies are most prevalent, but reduced to low with mitigation measures. Leishmaniasis is transmitted by sand flies. A small number of cases (less than 1 percent per month attack rate) could occur among personnel exposed to sandfly bites in areas with infected people, rodents, dogs, or other reservoir animals. In groups of personnel exposed to heavily infected sandflies in focal areas, attack rates can be very high (over 50 percent). 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 seven days.

6.2.3 Crimean-Congo hemorrhagic fever

High, mitigated to Low: Unmitigated risk is High, but reduced to low with mitigation measures. Crimean-Congo hemorrhagic fever occurs in a small number of cases (less than one percent per month attack rate) 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 five percent to 50 percent.

6.2.4 Sandfly fever

Moderate, mitigated to Low: Sandfly fever has a Moderate risk with potential disease rates from one percent to 10 percent per month; under worst case conditions disease rates can be as high as 50 percent. 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 one to seven days of supportive care followed by return to duty.

6.2.5 Plague

Low: Potential health risk to U.S. personnel is Low year round. Bubonic plague typically occurred 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 percent per month attack rate) could occur. Incidence could result in potentially severe illness which may require more than seven days of hospitalization and convalescence.

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

Moderate, mitigated to Low: Potential health risk to U.S. personnel is Moderate during warmer months (typically March through November) when vector activity is highest. Mitigation measures reduced the risk to low. 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 are insufficient to assess potential disease rates, attack rates can be very high (over 50 percent) in groups of personnel exposed to heavily infected "mite islands" in focal areas. The disease can cause debilitating febrile illness typically requiring one to seven days of inpatient care, followed by return to duty.

6.2.7 West Nile fever

Low: West Nile fever is present. The disease is maintained by the bird population and transmitted to humans via mosquito vector. Typically, infections in young, healthy adults were asymptomatic although fever, headache, tiredness, body aches (occasionally with a skin rash on trunk of body), and swollen lymph glands can occurred. This disease is associated with a low risk estimate.

6.2.9 Short -term health risks:

Low: The unmitigated health risk estimate is, High for Crimean-Congo hemorrhagic fever, Moderate for leishmaniasis-cutaneous (acute), sandfly fever, typhus-miteborne; and Low for, the plague, malaria and West Nile fever (infection rate of less than one percent per month). Health risk is 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.

6.2.10 Long-term health risks:

Low: The unmitigated risk is moderate for leishmaniasis-visceral (chronic). Risk is reduced to Low by proper wear of the uniform and application of repellent to exposed skin. Confidence in the risk estimate is high.

6.3 Water Contact Diseases

Operations or activities that involve extensive water contact may result 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 are likely to be contaminated with human and animal waste. Activities such as wading or swimming may result in exposures to enteric diseases such as 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 such as bacterial or fungal dermatitis. Mitigation strategies were in place and included avoiding water contact and recreational water activities, proper wear of uniform (especially footwear), and protective coverings for cuts/abraded skin.

6.3.1 Leptospirosis

Moderate, mitigated to Low: Human infections occur seasonally (typically April through November) through exposure to water or soil contaminated by infected animals and is associated with wading, and swimming in contaminated, untreated open water. The occurrence of flooding after heavy rainfall facilitates the spread of the organism because as water saturates the environment *Leptospira* spp. present in the soil passes directly into surface waters. *Leptospira* spp can enter the body through cut or abraded skin, mucous membranes, and conjunctivae. Infection may also occur from ingestion of contaminated water. The acute, generalized illness associated with infection may mimic other tropical diseases (for example, dengue fever, malaria, and typhus), and common symptoms include fever, chills, myalgia, nausea, diarrhea, cough, and conjunctival suffusion. Manifestations of severe disease can include jaundice, renal failure, hemorrhage, pneumonitis, and hemodynamic collapse. Recreational activities involving extensive water contact may result in personnel being temporarily debilitated with leptospirosis. Incidence could result in debilitating febrile illness typically requiring one to seven days of inpatient care, followed by return to duty; some cases may require prolonged convalescence. This disease is associated with a Moderate health risk estimate.

6.3.2 Short-term health risks:

Low: Unmitigated Health risk of leptospirosis is Moderate during warmer months. Mitigation measures reduce the risk to Low. Confidence in the health risk estimate is 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 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, measles, and others. The U.S. military populations living in close-quarter conditions are at risk for substantial person-to-person spread of respiratory pathogens. Influenza is of particular concern because of its ability to debilitate large numbers of unvaccinated personnel for several days. Mitigation strategies were in place and included routine medical screenings, vaccination, enforcing minimum space allocation in housing units, implementing head-to-toe sleeping in crowded housing units, implementation of proper personal protective equipment (PPE) when necessary for healthcare providers and detention facility personnel.

6.4.1 TB

Moderate, mitigated to Low: Potential health risk to U.S. personnel is Moderate, mitigated to Low, year round. Transmission typically requires close and prolonged contact with an active case of pulmonary or laryngeal TB, although it also can occur with more incidental contact. Individuals with prolonged indoor exposure to the local population are at increased risk for latent TB infection.

6.4.2 Meningococcal meningitis

Low: Meningococcal meningitis poses a Low risk and is transmitted from person to person through droplets of respiratory or throat secretions. Close and prolonged contact facilitates the spread of this disease. Meningococcal meningitis is potentially a very severe disease typically requiring intensive care; fatalities may occur in five to 15 percent of cases.

6.4.3 Middle East respiratory syndrome coronavirus (MERS-CoV)

Low: Although no cases have been reported in Afghanistan, Middle East respiratory syndrome coronavirus (MERS-CoV) is known to occur within the region. Most MERS patients developed severe acute respiratory illness with symptoms of fever, cough and shortness of breath. MERS-CoV has spread from ill people to others through close contact, such as caring for or living with an infected person. The incubation period for MERS-CoV is usually about five to six days, but can range from two to 14 days. Currently, there is no vaccine to prevent MERS-CoV infection.

6.4.4 Short-term health risks:

Low: Moderate (TB) to Low (for meningococcal meningitis and MERS-CoV). Overall risk was reduced to Low with mitigation measures. Confidence in the health risk estimate is high.

6.4.5 Long-term health risks:

None identified based on available data. Tuberculosis is evaluated as part of the post deployment health assessment. A TB skin test is required post-deployment if potentially exposed and is based upon individual service policies.

6.5 Animal-Contact Diseases

6.5.1 Rabies

Moderate, mitigated to Low: Rabies posed a year-round moderate risk. Occurrence in local animals was well above U.S. levels due to the lack of organized control programs. Dogs are the primary reservoir of rabies in Afghanistan, 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. A U.S. Army Soldier deployed to Afghanistan from May 2010 to May 2011 died of rabies in New York on 31 August 2011 (Reference 7). Laboratory results indicated the Soldier was infected from contact with a dog while deployed. Although the vast majority (greater than 99 percent) 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 1C, reduction of animal habitats, active pest management programs, and timely treatment of feral animal scratches/bites.

6.5.2 Anthrax

Low: Anthrax cases are rare in indigenous personnel, and pose a Low risk to U.S. personnel. Anthrax is a naturally occurring infection; cutaneous anthrax is transmitted by direct contact with infected animals or carcasses, including hides. Eating undercooked infected meat may result in contracting gastrointestinal anthrax. Pulmonary anthrax is contracted through inhalation of spores and is extremely rare. Mitigation measures included consuming approved food sources, proper food preparation and cooking temperatures, avoidance of animals and farms, dust abatement when working in these areas, vaccinations, and proper PPE for personnel working with animals.

6.5.3 Q-Fever

Moderate, mitigated to Low: Potential health risk to U.S. personnel is Moderate, but mitigated to Low, year round. Rare cases are possible among personnel exposed to aerosols from infected animals, with clusters of cases possible in some situations. Significant outbreaks (affecting 1-50 percent) can occur in personnel with heavy exposure to barnyards or other areas where animals are kept. Unpasteurized milk may also transmit infection. The primary route of exposure is respiratory, with an infectious dose as low as a single organism. Incidence could result in debilitating febrile illness, sometimes presenting as pneumonia, typically requiring one to seven days of inpatient care followed by return to duty. Mitigation strategies in place as listed in paragraph 6.5.2 except for vaccinations.

6.5.4 Avian influenza

Low: Potential health risk to U.S. personnel is Low. Although avian influenza (AI) is easily transmitted among birds, bird-to-human transmission is extremely inefficient. Human-to-human transmission appears to be exceedingly rare, even with relatively close contact. Extremely rare cases (less than 0.01 percent per month attack rate) could occur. Incidence could result in very severe illness with fatality rate higher than 50 percent in symptomatic cases. Mitigation strategies included avoidance of birds/poultry and proper cooking temperatures for poultry products.

6.5.5 Short-term health risks:

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

6.5.6 Long-term health risks:

Low: A Low long term risk exists for rabies because, in rare cases, the incubation period for rabies can be several years.

6.6 Soil-transmitted helminths (hookworm, strongyloidiasis, cutaneous larva migrans)

Moderate, mitigated to Low: Potential health risk to U.S. personnel is Moderate during warmer months (typically March through November) when vector activity is highest. Mitigation measures reduced the risk to low. A small number of cases (less than one percent per month attack rate) could occur among personnel with direct skin exposure to soil contaminated with human or animal feces (including sleeping on bare ground, walking barefoot). Initial skin symptoms typically are mild and are not debilitating. However, systemic symptoms of fever, cough, abdominal pain, nausea, and diarrhea may develop weeks to months after initial infection with hookworm or *Strongyloides* spp. More severe infections with high worm burden may be debilitating in some cases. Rates of infection in U.S. personnel will be highly variable, depending on specific local environmental conditions. Rates of infection in U.S. personnel are expected to be less than one percent per month in most locations. However, rates in some focal areas with heavily contaminated soil could exceed one percent per month.

6.6.1 Short-term health risks:

Low: Moderate for soil transmitted helminthes. Overall risk was reduced to Low with mitigation measures. Confidence in the health risk estimate is high.

6.6.2 Long-term health risks:

None identified based on available data.

7 Venomous Animals

All information was taken directly from the Armed Forces Pest Management Board (Reference 8) and the Clinical Toxinology Resources web site from the University of Adelaide, Australia (Reference 9). The species listed below have home ranges that overlap the location of Herat and vicinity, and may present a health risk if they are encountered by personnel. See Section 9 for more information about pesticides and pest control measures.

7.1 Spiders

- *Latrodectus 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

- *Androctonus amoreuxi* and *Androctonus baluchicus*: Severe envenoming possible, potentially

lethal. Severe envenoming may produce direct or indirect cardio toxicity, with cardiac arrhythmias, cardiac failure. Hypovolaemic hypotension possible in severe cases due to fluid loss through vomiting and sweating.

- *Buthacus striffleri, Compsobuthus afghanus, Compsobuthus rugosulus, Mesobuthus caucasicus, Mesobuthus eupeus, Mesobuthus macmahoni, Orthochirus bicolor, Orthochirus danielleae, Orthochirus erardi, Orthochirus heratensis, Orthochirus monodi, Orthochirus pallidus, Orthochirus scrobiculosus,* and *Sassanidotus gracilis*: 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 these species fit within that spectrum.

- *Hottentotta alticola* and *Hottentotta saulcyi*: Moderate envenoming 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.

7.3 Snakes

- *Echis carinatus multisquamatus* (central Asian saw-scaled viper) and *Gloydius halys* (Haly's pit viper): Severe envenoming possible, potentially lethal. Bites may cause moderate to severe coagulopathy and haemorrhagins causing extensive bleeding.

- *Macrovipera lebetina turanica* (Turan blunt-nosed viper: Severe envenoming possible, potentially lethal. Bites may cause mild to severe local effects, shock & coagulopathy.

- *Pseudocerastes persicus* (Persian horned viper): Unlikely to cause significant envenoming; limited clinical data suggest bites result in local effects only.

- *Gloydius intermedius* (Central Asian pit viper): Potentially lethal envenoming, though unlikely, cannot be excluded. Bites cause in local and sometimes systemic effects including necrosis, coagulopathy, and renal failure.

7.4 Short-term health risk:

Low: If encountered, effects of venom vary with species from mild localized swelling (e.g., widow spider) to potentially lethal effects (e.g., Haly's pit viper). See effects of venom above. Mitigation strategies included avoiding contact, proper wear of uniform (especially footwear), and timely medical treatment. Confidence in the health risk estimate is low (Reference 5, Table 3-6).

7.5 Long-term health risk:

None identified.

8 Heat/Cold Stress

8.1 Heat

Risk of an individual suffering a heat illness is not determined by a single threshold value. Instead a variety of risk factors, including environmental conditions, clothing, and activity level are examined on a daily basis to determine the degree of heat stress risk to units. Risk factors that influence heat illness risk include the wet bulb globe temperature category, previous daily wet bulb globe temperature categories, previous and projected daily workload and level of exertion, days of heat acclimatization,

amount of quality sleep, level of fitness and health, use medications, supplements, dietary aids, alcohol, previous instances of heat illness, and age.

Average daily high temperatures for Herat and vicinity exceed 78 degrees Fahrenheit (°F) from April through November based on historical climatological data from the U.S. Air Force Combat Climatology Center, 14th Weather Squadron. Therefore, heat stress hazards should have been assessed and a risk matrix should have been employed daily to determine the degree of heat illness risk.

Once risk levels from heat stress are determined, preventive measures can be implemented to mitigate heat illness casualties. Preventive measures for heat illness casualties include education and communication of heat casualty prevention information, identification of individuals who exhibit risk factors, implementation of work-rest guides, proper hydration and food intake, and use of recommended clothing (Reference 10).

8.1.1 Short-term health risk:

Variable, mitigated to Low: Heat illness risk factors across the population at Herat and vicinity were assessed to determine the heat illness risk level to units. The variety of risk factors resulted in variable risk of heat stress across the population. The risk of heat illness was reduced to Low through implementation of preventive measures. Confidence in the health risk estimate is Low (Reference 5, Table 3-6).

8.1.2 Long-term health risk:

Unknown. Long-term health effects from exposure to high levels of heat stress are not adequately documented and available data appears inconclusive (Reference 11).

8.2 Cold

As with heat stress, cold stress is largely dependent on operational and individual factors instead of environmental factors alone. Cold stress can be assessed by determining the air temperature, wind speed, if an individual becomes wet due to precipitation or water immersion, use of proper gear, availability of adequate shelter, proper fitness, proper food and hydration, degree of mobility, and contact with conductive cooling surfaces (Reference 12).

Ambient mean daily low temperatures at Herat and vicinity historically range from 30°F to 41°F from December through March with an average temperature of 34°F based on the U.S. Air Force Combat Climatology Center, 14th Weather Squadron. Wetness or wet clothes may have presented a hazard of non-cold freezing injuries. Additionally, from October through April temperatures after sunset can drop by as much as 40°F, indicating that cold stress may have presented a hazard.

Preventive measures were implemented to mitigate cold injury casualties. Preventive measures for non-cold freezing injuries and cold illness include education and communication of cold casualty prevention information, use of recommended clothing and personal protection, activity to keep warm, proper hydration and food intake, and use of adequate shelter.

8.2.1 Short-term and long-term health risk:

Low: The health risk of cold injury is Low. Confidence in the health risk estimate is Medium (Reference 5, Table 3-6).

9 Noise

9.1 Continuous

Camp Arena. Generators were a source of noise to personnel working in the vicinity. No specific decibels were measured. Personnel that work near the generator for long periods of time wear personnel protective equipment (PPE). The airfield is also a source of noise at Camp Arena. No specific decibels were measured at the airfield but personnel wear PPE when working in close proximity to any aircraft.

9.1.1 Short and long-term health risks:

Not evaluated

9.2 Impulse

No specific hazard sources were documented in the DOEHRS from 1 January 2016 to 31 December 2016.

9.2.1 Short-term and Long-term health risks:

Not evaluated.

10 Unique Incidents/Concerns

10.1 Potential environmental contamination sources

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

10.2 Waste Sites/Waste Disposal

Camp Arena: Solid waste was collected and transported to the Herat City burn pit which is approximately ten kilometers west of the Camp.

10.3 Fuel/petroleum products/industrial chemical spills

Camp Arena: No known product/industrial spills were reported in 2016. There was no information available for fuel/petroleum spills in 2016 (Reference 4).

10.4 Pesticides/Pest Control:

The health risk of exposure to pesticide residues is considered within the framework of typical residential exposure scenarios, based on the types of equipment, techniques, and pesticide products that have been employed, such as enclosed bait stations for rodenticides, various handheld equipment for spot treatments of insecticides and herbicides, and a number of ready-to-use methods such as aerosol cans and baits. The control of rodents required the majority of pest management inputs, with the acutely toxic rodenticides staged as solid formulation lethal baits placed in tamper-resistant bait stations indoors and outdoors throughout cantonment areas. Nuisance insects, including biting and stinging insects such as bees, wasps, and ants, also required significant pest management inputs. Use of pesticides targeting against these pests generally involved selection of compounds with low mammalian toxicity and short-term residual using pinpoint rather than broadcast application techniques. No specific hazard sources were documented in DOEHRS data portal. No monthly pesticide application reports were found in the data portal for Herat and vicinity in 2016. Therefore, risk from pesticide use could not be evaluated.

The Italian and American sides of Camp Arena all have a defined process for handling their pest management and there are contractors responsible for all pesticide application.

10.5 Asbestos

Specific asbestos hazard sources were not documented in the DOEHRS in 2016.

10.6 Lead Based Paint

Specific lead based paint hazard sources were not documented in the DOEHRS in 2016.

10.7 Burn Pit

Camp Arena: Solid waste was collected and transported to the Herat City burn pit which is located approximately 10 kilometers west of the Camp. Prevailing winds in Herat are from the north from April through September, from the south from November through February, and from the west in March and October. (Reference 4).

While not specific to Herat 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 13). The Institute of Medicine committee's (Reference 13) 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. There were no samples collected at the burn pit in 2016.

11 References

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

3. Joint Staff Memorandum (MCM) 0017-12, Procedures for Deployment Health Surveillance, 2012.

4. Occupational & Environmental Health Site Assessment, Camp Arena, Afghanistan, 983rd Medical Detachment, Afghanistan, July 2016

5. USAPHC TG230, June 2013 Revision.

6. Modification 12 to United States Central Command Individual Protection and Individual Unit Deployment Policy, 02 December 2013.

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

8. Armed Forces Pest Management Board: http://www.afpmb.org/content/venomous-animals-country#Afghanistan. U.S. Army Garrison - Forest Glen, Silver Spring, MD.

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

10. Technical Bulletin Medical 507. Heat Stress Control and Heat Casualty Management. Headquarters, Department of the Army and Air Force. 7 March 2003.

11. American Conference of Governmental Industrial Hygienists. Heat Stress and Strain: TLV Physical Agents. 2007.

12. Technical Bulletin Medical 508. Prevention and Management of Cold-Weather Injuries. Headquarters, Department of the Army. April 2005.

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

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 Deputy Assistant Secretary of Defense for Health Readiness Policy and Oversight (HRP&O).
Army Public Health Center 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.med.navy.mil/sites/nmcphc/Pages/Home.aspx
U.S. Air Force School of Aerospace Medicine (USAFSAM) (formerly AFIOH) Phone: (888) 232-3764. http://www.wpafb.af.mil/afrl/711hpw/usafsam/
DoD Health Readiness Policy and Oversight (HRP&O) Phone: (800) 497-6261. https://health.mil/Military-Health-Topics/Health-Readiness