Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Camp Buehring, Kuwait
Calendar Years: (2004 to 2015)

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 Camp Buehring, Kuwait. It presents a qualitative summary of OEH risks identified at this location and their potential medical implications. The report is based on information collected from 01 Jan 2004 through 31 Dec 2015 to include deployment OEH surveillance sampling and monitoring data (e.g., air, water, and soil), field investigation and health assessment reports, as well as country and area-specific information on endemic diseases.

This assessment assumes that environmental sampling at Camp Buehring 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 01 Jan 2004 through 31 Dec 2015.

The POEMS can be useful to inform healthcare providers and others of environmental conditions experienced by individuals deployed to Camp Buehring 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:

Camp Buehring (formerly Camp Udairi) is located approximately 40 kilometers (km) from the Iraq border. The area surrounding Camp Buehring, known as the Udairi Range Complex, is largely uninhabited, save for a few nomadic Bedouin tribes and their livestock. Camp Buehring has served as the staging and training base for Iraq-bound troops.

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 Camp Buehring. 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 Camp Buehring, Kuwait:

Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}) from environmental dust (including any burn pits or incinerators that might have existed); inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) from environmental dust (including any burn pits or incinerators that might have existed); food/waterborne diseases (e.g., bacterial diarrhea, hepatitis A, typhoid/paratyphoid fever, diarrhea-cholera, diarrhea-protozoal, brucellosis, hepatitis E); other endemic diseases (malaria, 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 (malaria, 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 during months of March through November, and 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 (including any burn pits or incinerators that might have existed), the PM_{10} overall short-term health risk was 'Low to High.' For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) from environmental dust (including burn pits or incinerators that might have existed), the $PM_{2.5}$ overall short-term health risk was 'Low to Moderate.' However, the entire Camp Buehring and vicinity area is an arid and dust-prone desert environment, 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. Burn pits and/or incinerators might have existed Camp Buehring and vicinity (for example, burn pits used by the local population); however, there are no reports or sampling data to indicate their presence or absence. Consequently, the PM10 and the PM2.5 overall short-term health risks specifically for burn pits were not evaluated – see Section 10.7. Where burn pits and/or incinerators might have existed, 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 Camp Buehring 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 Camp Buehring, Kuwait:

Air quality: For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) from environmental dust (including burn pits or incinerators that might have existed), the overall long-term health risk was 'Moderate. Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}) from environmental dust (including burn pits or incinerators that might have existed) was not evaluated for long-term health risk due to no available health guidelines. However, the entire Camp Buehring and vicinity area is an arid and dust-prone desert environment, also subject to vehicle traffic, and conditions may have varied. Burn pits and/or incinerators might have existed Camp Buehring and vicinity (for example, burn pits used by the local population); however, there are no reports or sampling data to indicate their presence

or absence. 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 - Camp Buehring [1, 2]

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
AIR			
Particulate matter less than 10 micrometers in diameter (PM_{10})	Short-term: Low to High, Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/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: Low to High, Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/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: Low to Moderate, A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: Low to Moderate, A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.
	Long-term: Moderate. 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: Moderate. 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).
Water			
Consumed Water (Water Used for Drinking)	Short-term: Low for peak antimony sample concentration. Acute effects of antimony in drinking water may cause nausea, vomiting, and diarrhea	U.S. Army Public Health Command (USAPHC) former U.S. Army Veterinary Command (VETCOM) approved bottled water and potable water only from approved water sources	Short-term: Low for peak antimony sample concentration. Acute effects of antimony in drinking water may cause nausea, vomiting, and diarrhea
	Long-term: None identified based on available data		Long-term: None identified based on available data
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, 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: Moderate for malaria, leishmaniasis - cutaneous (acute), Crimean-Congo hemorrhagic fever, sandfly fever, typhus-miteborne; and Low for, the plague 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	Short-term: Low
	Long-term: Low for Leishmaniasis-visceral infection.		Long-term: No data available

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
		chemoprophylaxis.	
Water-Contact (e.g., wading, swimming)	Short-term: Moderate for leptospirosis	Recreational swimming in surface waters not likely in this area of Kuwait 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.	Providing adequate living and work space; medical screening; vaccination.	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 H5N1 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/ INSECTS			
Snakes, scorpions, and spiders	Short-term: Low; If encountered, effects of venom vary with species from mild localized swelling (e.g., *Scorpio maurus*) to potentially lethal effects (e.g. *Vipera albicornuta*).	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., *Scorpio maurus*) to potentially lethal effects (e.g. *Vipera albicornuta*).
	Long-term: No data available		Long-term: No data available
HEAT/COLD STRESS			
Heat	Short-term: Variable; risk of heat stress/injury based on temperatures alone is Low from December – February, High for March and November, and Extremely High from April – October.	Work-rest cycles, proper hydration and nutrition, and Wet Bulb Globe Temperature (WBGT) monitoring.	Short-term: Variable; Risk of heat injury in unacclimatized or susceptible personnel is High from April – October, Moderate for March and November, and Low from December – February.
	Long-term: Low, however the risk may be greater to certain susceptible persons–those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.		Long-term: Low, however the risk may be greater to certain susceptible persons–those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.
Cold	Short-term: Low risk of cold stress/injury.	Risks from cold stress reduced with protective	Short-term: Low risk of cold stress/injury.

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
	Long-term: Low; Long-term health implications from cold injuries are rare but can occur, especially from more serious injuries such as frost bite.	measures such as use of the buddy system, limiting exposure during cold weather, proper hydration and nutrition, and proper wear of issued protective clothing.	Long-term: Low; Long-term health implications from cold injuries are rare but can occur, especially from more serious injuries such as frost bite.
Unique Incidents/ Concerns			
Burn Pits	Short-term: Burn pits and/or incinerators might have existed Camp Buehring and vicinity (for example, burn pits used by the local population); however, there are no reports or sampling data to indicate their presence or absence. 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. A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.	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: Burn pits and/or incinerators might have existed Camp Buehring and vicinity (for example, burn pits used by the local population); however, there are no reports or sampling data to indicate their presence or absence. 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. A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.
	Long-term: Burn pits and/or incinerators might have existed Camp Buehring and vicinity (for example, burn pits used by the local population); however, there are no reports or sampling data to indicate their presence or absence. 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.		Long-term: Burn pits and/or incinerators might have existed Camp Buehring and vicinity (for example, burn pits used by the local population); however, there are no reports or sampling data to indicate their presence or absence. 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.

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]

[1]This Summary Table provides a qualitative estimate of population-based short- and long-term health risks associated with the occupational environment conditions at Camp Buehring. 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 01 Jan 2004 through 31 Dec 2015. 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 Camp Buehring. 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 Camp Buehring, Kuwait by Source

The following sections provide additional information about the OEH conditions summarized above. All risk assessments were performed using the methodology described in the U.S. Army Public Health Command (USAPHC) Technical Guide 230, *Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel* (Reference 4). All OEH risk estimates represent residual risk after accounting for preventive controls in place. Occupational exposures and exposures to endemic diseases are greatly reduced by preventive measures. For environmental exposures related to airborne dust, there are limited preventive measures available, and available measures have little efficacy in reducing exposure to ambient conditions.

The ProUCL version 5.0 software package was used for statistical analyses (Reference 5). Means are followed by standard deviation (SD). Risk characterization was based on the 95 percent upper confidence level of the arithmetic mean (95% UCL) or the arithmetic mean depending on the quality and quantity of the data being evaluated. The sample mean is an uncertain estimate of the true mean of the population exposure point concentration (PEPC). The 95% UCL reduces the uncertainty inherent in the sample mean and states with a higher level of confidence that the mean PEPC is no greater than the 95% UCL.

2 Air

2.1 Site-Specific Sources Identified

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

2.3.1 Exposure Guidelines:

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

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

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

- Not defined and not available.

2.3.2 Sample data/Notes:

A total of 132 valid PM_{10} air samples were collected from 10 June 2004 to 24 November 2008. The results of the 24-hour PM_{10} sample concentrations with a range of 14 µg/m^3 – 852 µg/m^3, mean = 191 µg/m^3, SD = 152.2 µg/m^3, and 95% UCL = 213 µg/m^3.

2.3.3 Short-term health risks:

Low to High: The short-term health risk assessment was below the negligible hazard severity level based on the 95% UCL of the PM_{10} sample concentration and High for peak PM_{10} sample concentrations at Camp Buehring. Daily average health risk levels for PM_{10} at Camp Buehring show no hazard for 78%, Low health risk for 15%, Moderate health risk for 4%, and High health risk for 3% of the time. Confidence in the short-term PM_{10} health risk assessment is low (Reference 4, Table 3-6).

For the highest observed PM_{10} sample concentration, the hazard severity was critical. During peak exposures above the critical hazard severity level (600 µg/m^3), 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. Those with a history of asthma or cardiopulmonary disease may experience more severe symptoms. (Reference 4, Table 3-11).

2.3.4 Long-term health risk:

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

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

2.4.1 Exposure Guidelines:

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

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

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

- Negligible MEG = 15
- Marginal MEG = 65.

2.4.2 Sample data/Notes:

A total of 215 valid $PM_{2.5}$ air samples were collected from 9 October 2005 to 8 September 2015. The results of the 24-hour PM_{10} sample concentrations with a range of 4 µg/m^3 – 435 µg/m^3, mean = 75 µg/m^3, SD = 65 µg/m^3, and 95% UCL = 94 µg/m^3.

2.4.3 Short-term health risks:

Low to Moderate: The short-term $PM_{2.5}$ health risk assessment is Low to Moderate for peak $PM_{2.5}$ sample concentrations. A Low health risk is expected to have little or no impact on accomplishing the mission (Reference 4, Table 3-2). Daily average health risk levels for $PM_{2.5}$ at Camp Buehring show no hazard for 61%, low health risk for 35%, and moderate health risk for 4% of the time. Confidence in the short-term $PM_{2.5}$ health risk assessment is low (Reference 4, Table 3-6).

The results of the 95% UCL indicate that the hazard severity was negligible (65 µg/m^3 to 250 µg/m^3) for $PM_{2.5}$ sample concentrations. During typical exposures at the negligible hazard severity level, few

exposed personnel (if any) are expected to have noticeable health effects during mission (Reference 4, Table 3-6).

For the highest observed $PM_{2.5}$ exposure, the hazard severity was critical (≥ 500 µg/m^3). During peak exposures at the critical hazard severity level, exposed personnel will have limited ability to perform most critical tasks (Reference 4, Table 3-6).

2.4.4 Long-term health risks:

Moderate: The long-term health risk assessment is Moderate. A Moderate health risk level suggests that long-term exposure to $PM_{2.5}$ is expected to require limited future medical surveillance activities and related resources (Reference 4, Table 3-3). Confidence in the long-term $PM_{2.5}$ health risk assessment is low (Reference 4, Table 3-6).

The results of the 95% UCL indicate that the hazard severity was marginal (≥ 65 µg/m^3) for typical $PM_{2.5}$ sample concentrations. The results suggest that with repeated exposures above the marginal hazard severity threshold, it is plausible that development of chronic health conditions such as reduced lung function or exacerbated chronic bronchitis, chronic obstructive pulmonary disease (COPD), asthma, atherosclerosis, or other cardiopulmonary diseases could occur in generally healthy troops. Those with a history of asthma or cardiopulmonary disease are considered to be at particular risk (Reference 4, Table 3-12).

2.5 Airborne Metals

2.5.1 Exposure Guidelines:

2.5.2 Sample data/Notes:

A total of 132 valid PM_{10} air samples were collected from 10 June 2004 to 24 November 2008. No detected metal concentrations exceeded the short- or long-term MEGs.

A total of 215 valid airborne metal $PM_{2.5}$ samples were collected from 9 October 2005 to 8 September 2015. No detected metal concentrations exceeded the short- or long-term MEGs.

2.5.3 Short-term health risks:

None identified based on the available sampling data.

2.5.4 Long-term health risks:

None identified based on the available sampling data.

2.6 Volatile Organic Compounds (VOC)

2.6.1 Exposure Guidelines:

2.6.2 Sample data/Notes:

A total of five valid volatile organic chemical (VOC) air samples collected from 15 February 2007 to 9 February 2007. None of the analyzed VOC pollutants were found at concentrations above short or long-term MEGs.

2.6.3 Short and long-term health risks:

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

2.6.3 Short and long-term health risks:

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 79 valid surface soil samples were collected from 1 May 2006 to 9 February 2009, to assess OEH health risk to deployed personnel. The primary soil contamination exposure pathways are dermal contact and dust inhalation. Typical parameters analyzed for included semi volatile organic compounds (SVOCs), heavy metals, polychlorinated biphenyls (PCBs), pesticides, and 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 nine samples, 50 > 75% for one sample, 25 <50% for two samples, 10 > 25% for 44 sample, and < 10% for 23 samples. For the risk assessment, personnel are assumed to remain at this location for 6 months to 1 year.

3.3 Short-term health risk:

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

3.4 Long-term health risk:

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

4 Water

In order to assess the health risk to U.S. personnel from exposure to water in theater, the APHC (PROV) 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. Based on the information provided from the field, all samples for untreated water samples were associated with source water for treatment and no exposure pathways were associated with those samples. Therefore, untreated samples are not assessed as potential health hazards. It is assumed that 100% of all U.S. personnel at Camp Buehring will be directly exposed to reverse osmosis water purification unit (ROWPU) treated, disinfected fresh bulk water, bottled water, and untreated well water since this classification of water is primarily used for personal hygiene, showering, cooking, and for use at vehicle wash racks. Field data sheets indicate that bottled water is the primary source of drinking water. Because treated water was used for personal hygiene to include brushing teeth, and for cooking, treated water was considered drinking water for the risk assessment.

4.1 Drinking Water: Disinfected and Bottled Water

4.1.1 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. According to field data sheets there were three bottled water brands used. However, the names of the bottled water brands were not listed.

4.1.2 Exposure Guidelines:

Short-term Antimony 14 day 5 liter (L)/day (milligrams per liter, mg/L):

- Negligible MEG = 0.014

Long-term Antimony 1 year 5L/day (mg/L):

- Negligible MEG = 0.006

4.1.3 Sample data/Notes:

Antimony (CASN 7440-36-0) is a naturally occurring silvery white metal. Small amounts of antimony can be released to the environment by incinerators and coal burning. Acute effects of antimony in drinking water may cause nausea, vomiting, and diarrhea (Reference 6).

Dimethylphthalate (CASN 131-11-3). Dimethyl phthalate is used in manufacturing solid rocket propellant and consumer products such as insect repellents and plastics. Phthalates are metabolized and excreted quickly and do not accumulate in the body (Reference 7).

To assess the potential for adverse health effects to troops, the following assumptions were made about dose and duration: A conservative (protective) assumption was that personnel routinely ingested 5 L/day of drinking water for up to 365 days (1-year). It was further assumed that control measures were not used. A total of 28 valid treated water samples and two valid bottled water samples collected from 24 July 2005 to 26 March 2015 were analyzed to characterize risk of drinking water at Camp Buehring. A single sample detected antimony. The sample concentration of antimony was 0.022 mg/L which was above the 14 day 5L/d negligible MEG of 0.014 mg/L. Because antimony was detected in less than 5% of the total samples antimony was not evaluated as a potential long term hazard. Dimethylphthalate was detected in 17 samples with a range of 0.00035 mg/L to 0.024 mg/L, Average = 0.0022 mg/L, SD = 0.0046 mg/L, 95% UCL = 0.0059 mg/L. Currently, there are no MEGs or a water quality reference dose from the EPA associated with Dimethylphthalate. No other chemicals were above the short or long term MEGs.

4.1.4 Short-term and long-term health risk:

Low. The short-term health risk assessment is Low for peak antimony sample concentration. A Low health risk is expected little or no impact on accomplishing the mission (Reference 4, Table 3-2). Confidence in the short-term health risk assessment is low (Reference 4, Table 3-6).

4.1.5 Long-term health risk:

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

5 Military Unique

5.1 Chemical Biological, Radiological Nuclear (CBRN) Weapons

No specific hazard sources were documented in the Defense Occupational and Environmental Health Readiness System (DOEHRS) or the Military Exposure Surveillance Library (MESL) from 01 Jan 2004 through 31 Dec 2015 timeframe (References 1 and 8).

5.2 Depleted Uranium (DU)

No specific hazard sources were documented in the DOEHRS or MESL from 01 Jan 2004 through 31 Dec 2015 timeframe (References 1 and 8).

5.3 Ionizing Radiation

No specific hazard sources were documented in the DOEHRS or MESL from 01 Jan 2004 through 31 Dec 2015 timeframe (References 1 and 8).

5.4 Non-Ionizing Radiation

No specific hazard sources were documented in the DOEHRS or MESL from 01 Jan 2004 through 31 Dec 2015 timeframe (References 1 and 8).

6 Endemic Diseases

This document lists the endemic diseases reported in the region, the specific health risks and severity and general health information about the diseases. CENTCOM Modification (MOD) 12 (Reference 8) lists deployment requirements, to include immunizations and chemoprophylaxis, in effect during the timeframe of this POEMS.

6.1 Food borne and Waterborne Diseases

Food borne and waterborne diseases in the area are transmitted through the consumption of local food and water. Local unapproved food and water sources (including ice) are heavily contaminated with pathogenic bacteria, parasites, and viruses to which most U.S. Service Members have little or no natural immunity. Diarrheal diseases are expected to temporarily incapacitate a high percentage of U.S. personnel within days if local food, water, or ice is consumed. Hepatitis A can 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* spp.) 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 an operationally significant percentage of personnel (potentially 11% - 50% per month) within days if local food, water, or ice is consumed. Field conditions (including lack of hand washing and primitive sanitation) may facilitate person-to-person spread and epidemics. Typically mild disease treated in outpatient setting;

recovery and return to duty in less than 72 hours with appropriate therapy. A small proportion of infections may require greater than 72 hours limited duty, or hospitalization.

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

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

6.1.3 Short-term Health Risks:

Low: The overall unmitigated short-term risk associated with food borne and waterborne diseases are considered High (bacterial diarrhea) to Moderate (hepatitis A, typhoid/paratyphoid fever, diarrhea-cholera, diarrhea-protozoal, brucellosis, and hepatitis E) 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

Ecological conditions in rural areas support arthropod vectors, including ticks and sand flies, with variable rates of disease transmission. A variety of vector-borne diseases occur at low levels. Individually, most of these diseases are likely to cause only rare cases, but the overall risk may be significant in some areas. Mitigation strategies were in place and included proper wear of treated uniforms, application of repellent to exposed skin, and use of bed nets and chemoprophylaxis (when applicable). Additional methods included the use of pesticides, reduction of pest/breeding habitats, and engineering controls.

6.2.1 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. Rare cases (less than 0.1% per month attack rate) could occur among personnel exposed to sandfly bites in areas with infected people, rodents, dogs, or other reservoir animals. In groups of personnel exposed to heavily infected sandflies in focal areas, attack rates can be very high (over 50%). There are two forms of the disease; cutaneous (acute form) and visceral (a more latent form of the disease). The leishmaniasis parasites may survive for years in infected individuals and this infection may go unrecognized by physicians in the U.S. when infections become symptomatic years later. Cutaneous infection is unlikely to be debilitating, though lesions may be disfiguring. Visceral leishmaniasis disease can cause severe febrile illness which typically requires hospitalization with convalescence over 7 days.

6.2.2 Sandfly fever

Low: Sandfly fever has a Low risk. The disease is assessed as present; rare cases (less than 0.1% per month) cannot be ruled out among personnel exposed to sandfly bites. In small groups exposed to heavily infected sandfly populations in focal areas, attack rates can be very high (potentially up to 50%).

The disease is transmitted by sandflies and occurs more commonly in children though adults are still at risk. Sandfly fever disease typically resulted in debilitating febrile illness requiring 1 to 7 days of supportive care followed by return to duty

6.2.3 Sindbis (and Sindbis-like viruses)

Low: Risk of sindbis (and sindbis-like viruses) is Low. Disease is assessed as present; rare cases (less than 0.1% per month) cannot be ruled out among personnel exposed to mosquito bites. Debilitating febrile illness often accompanied by rash, typically requiring 1 to 7 days of supportive care; significant arthralgias can persist for several weeks or more in some cases.

6.2.4 West Nile fever

Low: Disease is assessed as present; rare cases (less than 0.1% per month) cannot be ruled out among personnel exposed to mosquito bites. The disease is maintained by the bird population and transmitted to humans via mosquito vector. Febrile illness typically requiring 1-7 days of inpatient care followed by return to duty; convalescence may be prolonged.

6.2.5 Short -term health risks:

Low: The unmitigated health risk estimate is Moderate for leishmaniasis-cutaneous (acute), and Low for sandfly fever, sindbis (and sindbis-like viruses) and West Nile fever. 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.

6.2.6 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.

Malaria was detected in *Anopheles* spp. of mosquitoes during a survey conducted from 4 April - 21 May 2008 (Reference 6).

6.3.1 Leptospirosis

Moderate, mitigated to Low: Human infections occur seasonally (typically April through October) 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* present

in the soil passes directly into surface waters. *Leptospira* 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 1 to 7 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, and others. The U.S. military populations living in close-quarter conditions are at risk for substantial person-to-person spread of respiratory pathogens. Influenza is of particular concern because of its ability to debilitate large numbers of unvaccinated personnel for several days. Mitigation strategies were in place and included routine medical screenings, vaccination, enforcing minimum space allocation in housing units, implementing head-to-toe sleeping in crowded housing units, implementation of proper personal protective equipment (PPE) when necessary for healthcare providers and detention facility personnel.

6.4.1 Tuberculosis (TB)

Moderate, mitigated to Low: Potential health risk to U.S. personnel is Moderate, mitigated to Low, year round. Transmission typically requires close and prolonged contact with an active case of pulmonary or laryngeal TB, although it also can occur with more incidental contact. 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 5-15% of cases.

6.4.3 Short-term health risks:

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

6.4.4 Long-term health risks:

None identified based on available data. Tuberculosis is evaluated as part of the post deployment health assessment (PDHA). 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 Q-Fever

Moderate, mitigated to Low: Potential health risk to U.S. personnel is Moderate, but mitigated to Low, year round. Rare cases are possible among personnel exposed to aerosols from infected animals, with clusters of cases possible in some situations. Significant outbreaks (affecting 1-50%) can occur in personnel with heavy exposure to barnyards or other areas where animals are kept. Unpasteurized milk may also transmit infection. The primary route of exposure is respiratory, with an infectious dose as low as a single organism. Incidence could result in debilitating febrile illness, sometimes presenting as pneumonia, typically requiring 1 to 7 days of inpatient care followed by return to duty. Mitigation 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.

6.5.2 H5N1 avian influenza

Low: Potential health risk to U.S. personnel is Low. Although H5N1 avian influenza (AI) is easily transmitted among birds, bird-to-human transmission is extremely inefficient. Human-to-human transmission appears to be exceedingly rare, even with relatively close contact. Extremely rare cases (less than 0.01% per month attack rate) could occur. Incidence could result in very severe illness with fatality rate higher than 50 percent in symptomatic cases. Mitigation strategies included avoidance of birds/poultry and proper cooking temperatures for poultry products.

6.5.5 Short-term health risks:

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

6.5.6 Long-term health risks:

None identified based on available data.

6.6 Aerosolized Dust or Soil-contact Diseases

6.6.1 *Hantavirus* hemorrhagic fever with renal syndrome (HFRS)

Low: Potential health risk to U.S. personnel is Low year round. Disease is assessed as present; extremely rare cases (less than 0.01% per month) cannot be ruled out among personnel exposed to dust or aerosols in rodent-infested areas. Attack rates exceeding 1% could occur in small groups exposed to areas with very heavy rodent infestation and dusty conditions. Potentially very severe disease typically requiring prolonged hospitalization, including intensive care; fatalities may occur. *Hantavirus Puumala virus* cases are typically less severe, but can debilitate personnel for several days.

6.6.2 Short-term health risks:

Low: Risk is Low for *Hantavirus* hemorrhagic fever with renal syndrome (HFRS). 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 9) and the Clinical Toxinology Resources web site from the University of Adelaide, Australia (Reference 10). The species listed below have home ranges that overlap the location of Camp Buehring 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 Scorpions

- *Androctonus crassicauda (black scorpion): Severe envenoming possible and potentially lethal, however most stings cause only severe local pain.*

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

- *Scorpio maurus*: Mild envenoming only, not likely to prove lethal.

7.2 Snakes

- *Cerastes gasperettii* (Gasperetti's horned viper): Potentially lethal envenoming, though unlikely.

- *Echis sochureki* (Sochurek's saw-scaled viper): Moderate to severe, potentially lethal envenoming.

- *Malpolon moilensis* (Hooded Malpolon), M*alpolon monspessulanus* (Montpellier snake): Clinical effects varies, but unlikely to cause significant envenoming.

- *Macrovipera lebetina* subspecies e*uphratica* and subspecies *obtuse* (Levantine viper), *Vipera albicornuta* (white-horned viper), (*Walterinnesia aegyptia* (black desert cobra*), and Vipera raddei* (Armenian Mountain Viper): Severe envenoming possible, potentially lethal.

7.3 Short-term health risk:

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

7.4 Long-term health risk:

None identified.

8 Heat/Cold Stress

8.1 Heat

Summer (June - September) monthly mean daily maximum temperatures range from 110 degrees Fahrenheit (°F) to 117 °F with an average temperature of 114 °F based on historical climatological data from the U.S. Air Force Combat Climatology Center, 14th Weather Squadron. The health risk of heat stress/injury based on temperatures alone is Low (< 78 °F) from December – February, high (82-87.9°F) for March and November, and extremely high (≥ 88°F) from April – October. However, work intensity and clothing/equipment worn pose greater health risk of heat stress/injury than environmental factors alone (Reference 11). Managing risk of hot weather operations included monitoring work/rest periods, proper hydration, and taking individual risk factors (e.g., acclimation, weight, and physical conditioning) into consideration. Risk of heat stress/injury was reduced with preventive measures.

8.1.1 Short-term health risk:

Low to Extremely High, mitigated to Low: The risk of heat injury was reduced to low through preventive measures such as work/rest cycles, proper hydration and nutrition, and monitoring Wet Bulb Globe Temperature (WBGT). Risk of heat injury in unacclimatized or susceptible populations (older, previous history of heat injury, poor physical condition, underlying medical/health conditions), and those under operational constraints (equipment, PPE, vehicles) is High from April – October, Moderate for March and November, and Low from December – February. Confidence in the health risk estimate is low (Reference 4, Table 3-6).

8.1.2 Long-term health risk:

Low: The long-term risk is Low. However, the risk may be greater for certain susceptible persons– those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions. Long-term health implications from heat injuries are rare but may occur, especially from more serious injuries such as heat stroke. It is possible that high heat in conjunction with various chemical exposures may increase long-term health risks, though specific scientific evidence is not conclusive. Confidence in these risk estimates is medium (Reference 4, Table 3-6).

8.2 Cold

Winter (December - March) mean daily minimum temperatures range from 50 °F to 59 °F with an average temperature of 54 °F based on historical climatological data from the U.S. Air Force Combat Climatology Center, 14th Weather Squadron. Because even on warm days a significant drop in temperature after sunset by as much as 40 °F can occur, there is a risk of cold stress/injury from December - March. The risk assessment for Non-Freezing Cold Injuries (NFCI), such as chilblain, trench foot, and hypothermia, is Low based on historical temperature and precipitation data. Frostbite is unlikely to occur because temperatures rarely drop below freezing. However, personnel may encounter significantly lower temperatures during field operations at higher altitudes. As with heat stress/injuries, cold stress/injuries are largely dependent on operational and individual factors instead of environmental factors alone (Reference 11).

8.2.1 Short-term health risks:

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

8.2.2 Long-term health risk:

Low: The health risk of cold injury is Low. Confidence in the health risk estimate is medium (Reference 4, Table 3-6).

9 Noise

9.1 Continuous

No specific hazard sources were documented in the DOEHRS or MESL from 01 Jan 2004 through 31 Dec 2015 timeframe.

9.1.1 Short and long-term health risks:

Not evaluated

9.2 Impulse

No specific hazard sources were documented in the DOEHRS or MESL from 01 Jan 2004 through 31 Dec 2015 timeframe.

9.2.1 Short-term and Long-term health risks:

Not evaluated.

10 Unique Incidents/Concerns

10.1 Potential environmental contamination sources

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

10.2 Waste Sites/Waste Disposal

No data were documented in the DOEHRS or MESL from 01 Jan 2004 through 31 Dec 2015 timeframe.

10.3 Fuel/petroleum products/industrial chemical spills

No data were documented in the DOEHRS or MESL from 01 Jan 2004 through 31 Dec 2015 timeframe.

10.4 Pesticides/Pest Control:

The health risk of exposure to pesticide residues is considered within the framework of typical residential exposure scenarios, based on the types of equipment, techniques, and pesticide products that have been employed, such as enclosed bait stations for rodenticides, various handheld equipment for spot treatments of insecticides and herbicides, and a number of ready-to-use (RTU) methods such as aerosol cans and baits. The control of rodents required the majority of pest management inputs, with the acutely toxic rodenticides staged as solid formulation lethal baits placed in tamper-resistant bait stations indoors and outdoors throughout cantonment areas. Nuisance insects, including biting and stinging insects such as bees, wasps, and ants, also required significant pest management inputs. Use of pesticides targeting against these pests generally involved selection of compounds with low mammalian toxicity and short-term residual using pinpoint rather than broadcast application techniques. No specific hazard sources were documented in DOEHRS or MESL data portal. A total of 183 pesticide application reports in the MESL data portal for Camp Buehring list the usage of pesticides on the site. For each pesticide product applied during this period, the EPA approved label has been archived, providing a framework how each pesticide handled and applied (see below).

10.4.1 Rodenticides

Brodifacoum, bromadiolone, bromethalin, diphacinone, and sodium salt of diphacinone were used to control rodents.

10.4.2 Insecticides

Insecticides used to control ants, bed bugs, cockroaches, crickets, gnats, fleas, flies, mosquitoes, silverfish, scorpions, and miscellaneous insects include: Lambda-cyhalothrin, 1,2-Propanediol, n-octyl bicycloheptene dicarboximide, (S)-hydroprene, (S)-methoprene, (Z)- 9- tricosene, *Bacillus thuringiensis* subspecies israelensis, carbaryl, chlorpyrifos, cypermethrin, DEET, deltamethrin, fipronil, hydramethylnon, imidacloprid, lambda-cyhalothrin, malathion, methomyl, nithiazine, n-Octyl bicycloheptene dicarboximide, piperonyl butoxide, poly (oxy-1 ,2-ethanediyl), a-(C16-20 branched and linear alkyl)-w-hydroxyl, pyrethrins, resmerithrin, and ß-Cyfluthrin.

10.4.3 Short-term and Long-term health risks

Low: Long term health risk is Low. Confidence in the health risk assessment is medium (Reference 4, Table 3-6).

10.5 Asbestos

No data were documented in the DOEHRS or MESL from 01 Jan 2004 through 31 Dec 2015 timeframe.

10.6 Lead Based Paint

No data were documented in the DOEHRS or MESL from 01 Jan 2004 through 31 Dec 2015 timeframe.

10.7 Burn Pit

No data were documented in the DOEHRS, MESL, or sample reports to indicate the presence or absence of burn pits or incinerators from 01 Jan 2004 through 31 Dec 2015 timeframe.

While there was no evidence of a burn pit at Camp Buehring, smoke from solid waste burning is still a potential concern because burning of solid waste may have been conducted by the local population. Therefore this additional information on burn pits is included. The consolidated epidemiological and environmental sampling and studies on burn pits that have been conducted as of the date of this publication have been unable to determine whether an association does or does not exist between exposures to emissions from the burn pits and long-term health effects (Reference 12). The Institute of Medicine committee's (Reference 12) review of the literature and the data suggests that service in Kuwait (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.

11 References

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

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

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

4. USAPHC TG230, June 2013 Revision.

5. Singh, A. and Singh, A.K. 2013. ProUCL Version 5.0. 00 Technical Guide-Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. EPA: Washington, WA, USA.

6. 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.

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

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

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

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

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

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

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.asp
DoD, Deputy Assistant Secretary of Defense for Health Readiness Policy and Oversight (HRP&O) Phone: (800) 497-6261. http://fhpr.dhhq.health.mil/home.aspx