Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS): Forward Operating Base Delaram II and Vicinity, Afghanistan Calendar Years: (2009 to 2014)

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

PURPOSE: This POEMS documents the Department of Defense (DoD) assessment of occupational and environmental health (OEH) risk for basecamps and locations in Nimruz Province of southwestern Afghanistan. The covered installations are Afghan National Police Station (ANP Station) in Delaram, Patrol Base (PB) Deh Mezong, Afghan Uniform Police Station in Delaram (Delaram AUP), Delaram District Center, Delaram Village Stability Support Platform (Delaram VSSP), Forward Operating Base (FOB) Delaram II, Patrol Base KDLE, and Delaram II Assistance Platform (AP). This POEMS presents a qualitative summary of health risks identified at these locations and their potential medical implications. The report is based on information collected from 1 October 2009 through 31 May 2014 to include deployment OEHS sampling and monitoring data (e.g., air, water, and soil), field investigation and health assessment reports, International Security Assistance Forces' environmental surveys, as well as country and area-specific information on endemic diseases.

This assessment assumes that environmental sampling at FOB Delaram II and vicinity during the assessment 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 these sites to be similar to those described in this report, the health risk assessment is limited to the time period between 1 October 2009 and 31 May 2014. All of the subject bases were closed prior to June 2014.

The POEMS can be useful to inform healthcare providers and others of environmental conditions experienced by individuals deployed to Nimruz Province 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(s)/treatment(s) noted in their medical record on a Standard Form (SF) 600 (Chronological Record of Medical Care).

SITE DESCRIPTION:

The basecamps were located in the northeastern corner of Nimruz Province in the western portion of the Regional Command – Southwest (RC-SW) area of operations. The base closure dates were as followed: ANP Station (6 December 2011), PB Deh Mezong (14 February 2012), Delaram AUP (23 June 2012), Delaram District Center (called Delaram in DOEHRS) (11 July 2012), Delaram VSSP (30 March 2013), and PB KDLE (6 December 2011). FOB Delaram II and Delaram II AP are found on the same location. FOB Delaram II transitioned from a FOB to a smaller assistance platform on 7 October 2012 with Delaram II AP closing on 5 May 2014. An Afghan National Army garrison occupied those portions of FOB Delaram II which were vacated during the transition to the Delaram II AP.

Nimruz – the third largest province in Afghanistan - is mostly flat and arid and is Afghanistan's most sparsely populated province. The Helmand River flows through the southern portion of the province. All the bases in this POEMS were located in the Delaram Provincial District. The city of Delaram is the district center and is a major transportation hub bisected by several key thoroughfares.

SUMMARY: Conditions that may pose a moderate or greater health risk are summarized in Table 1. Table 2 provides population based risk estimates for identified OEH conditions at FOB Delaram II 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 deployments at FOB Delaram II and vicinity:

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, anthrax, Q fever); heat stress; and cold 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, anthrax, Q fever), pose year-round risk. For heat stress, risk can be greater during months of May through October, 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. For cold stress, the risk of Non-Freezing Cold Injuries (NFCI), such as chilblain, trench foot, and hypothermia, is greater during the months of December through March. Risks from cold stress may have been 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.

Air quality: For inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}), the PM_{10} overall short-term risk was not evaluated due to insufficient data. For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$), the $PM_{2.5}$ overall short-term risk was not evaluated due to insufficient data. However, the entire FOB Delaram II 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 were in operation at Deh Mezong, Delaram AUP, Delaram District Center, FOB Delaram II, and PB KDLE. There was no burn pit in operation at Delaram VSSP and Delaram II AP and there is no information concerning burn pits for ANP Station. The Afghan National Army operated a burn pit next to Delaram II AP, where U.S. Forces operated a burn pit when the installation was known as FOB Delaram II. For FOB Delaram II and vicinity, the PM_{10} and the $PM_{2.5}$ overall short-term risks specifically for burn pits were not evaluated due to 'no environmental samples collected near burn pits provided for analysis' – 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. 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 deployments in FOB Delaram II and vicinity:

Air quality: For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$), the overall long-term risk was not evaluated due to insufficient data. Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}) was not evaluated for long-term risk due to no available health guidelines. However, the entire FOB Delaram II and vicinity area is an arid and dust-prone desert environment, also subject to vehicle traffic, and conditions may have varied. For burn pits, the PM_{10} and the $PM_{2.5}$ overall long-term risks were not evaluated at the burn pit locations at FOB Delaram II and vicinity due to 'no environmental samples collected near burn pits provided for analysis' and due to no available health guidelines for PM_{10} - 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 – FOB Delaram II and Vicinity[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: Insufficient data were available for risk analysis. Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: Insufficient data were available for risk analysis. Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).
	Long-term: No health guidelines		Long-term: No health guidelines
Particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$)	Short-term: Insufficient data were available for risk analysis. 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: Insufficient data were available for risk analysis. 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: Insufficient data were available for risk analysis. 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: Insufficient data were available for risk analysis. 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 UNIQUES			
Non-ionizing Radiation	Short-term: Low		Short-term: Low
	Long-term: Low		Long-term: Low
ENDEMIC DISEASE			
Food borne/Waterborne (e.g., diarrhea-bacteriological)	Short-term: Variable; High (bacterial diarrhea, hepatitis A, typhoid fever) to Moderate (diarrhea-cholera, diarrhea-protozoal, brucellosis, 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; High (malaria), Moderate (leishmaniasis - cutaneous (acute), Crimean-Congo hemorrhagic fever, sandfly fever, typhus-miteborne); to Low (plague, 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 (Leishmaniasis-visceral infection).		Long-term: No data available
Water-Contact	Short-term: Moderate (leptospirosis)	Recreational swimming in	Short-term: Low (leptospirosis).

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
(e.g. wading, swimming)	Long-term: No data available	surface waters not likely in this area of Afghanistan during this time period.	Long-term: No data available
Respiratory	Short-term: Variable; Moderate (tuberculosis (TB)), to Low (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 (rabies, anthrax, Q-fever), to Low (H5N1 avian influenza).	Prohibiting contact with, adoption, or feeding of feral animals IAW U.S. Central Command (CENTCOM) General Order (GO) 1B. 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
VENOMOUS ANIMAL/ INSECTS			
Snakes, scorpions, and spiders	Short-term: Low; If encountered, effects of venom vary with species from mild localized swelling (e.g. *Scorpiops lindbergi*) to potentially lethal effects (e.g. *Gloydius halys*).	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: High to Low; The unmitigated risk of heat injury in unacclimatized or susceptible personnel, and those under operational constraints is low from November – April, moderate for May and October and high from June to September based on historical temperature data.	Work-rest cycles, proper hydration and nutrition, and Wet Bulb Globe Temperature (WBGT) monitoring.	Short-term: The risk of heat injury was reduced to low. However, the risk may be greater to 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).
	Long-term: Low, The long-term risk was 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, The long-term risk is 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: The risk of Non-Freezing Cold Injuries (NFCI), such as chilblain, trench foot, and hypothermia, is moderate from December – March based on historical temperature and precipitation data.	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		Long-term: Low; Long-term health implications from cold injuries are rare but can occur, especially from more

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
	serious injuries such as frost bite.		serious injuries such as frost bite.
Unique Incidents/ Concerns			
Burn Pits	Short-term: Not evaluated because no environmental samples were collected near burn pits and provided for risk analysis. There were burn pits at Deh Mezong, Delaram AUP, Delaram District Center, FOB Delaram II, and PB KDLE. 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.	Control measures may have included locating burn pits downwind of prevailing winds, increased distance from living and working areas when possible, and improved waste segregation and management techniques	Short-term: There were burn pits at Deh Mezong, Delaram AUP, Delaram District Center, FOB Delaram II, and PB KDLE. 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: Not evaluated because no environmental samples were collected near burn pits and provided for risk analysis. There were burn pits at Deh Mezong, Delaram AUP, Delaram District Center, FOB Delaram II, and PB KDLE. 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: There were burn pits at Deh Mezong, Delaram AUP, Delaram District Center, FOB Delaram II, and PB KDLE. 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 FOB Delaram II and vicinity. 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 October 2009 through 31 May 2014. 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 for FOB Delaram II 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 (Provisional) (APHC (Prov)). Where applicable, "None Identified" is used when 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 FOB Delaram II 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 Command Technical Guide 230, *Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel* (Reference 4). All OEH risk estimates represent residual risk after accounting for preventive controls in place. Occupational exposures and exposures to endemic diseases are greatly reduced by preventive measures. For environmental exposures related to airborne dust, there are limited preventive measures available, and available measures have little efficacy in reducing exposure to ambient conditions.

2 Air

2.1 Site-Specific Sources Identified

FOB Delaram II and vicinity are situated in a dusty, arid environment in southwestern Afghanistan. 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:

There was one sample collected at FOB Delaram II on 30 November 2011. The measured 24-hour PM_{10} concentration was 64 $\mu g/m^3$.

2.3.3 Short-term and long-term health risks:

There was insufficient data to characterize the short-term PM_{10} health risks. 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) $PM_{2.5}$ ($\mu g/m^3$):

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

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

- Negligible MEG = 15
- Marginal MEG = 65

2.4.2 Sample data/Notes:

FOB Delaram II: A total of 11 valid $PM_{2.5}$ air samples were collected between 31 May 2010 and 16 November 2013. The range of measured 24-hour $PM_{2.5}$ concentrations was 11 $\mu g/m^3$ – 429 $\mu g/m^3$. Two of these samples were collected after FOB Delaram II transitioned to Delaram II AP. There were no $PM_{2.5}$ samples collected at the other basecamps/locations.

2.4.3 Short-term and long-term health risks:

Not evaluated. There was insufficient data to characterize the short- and long-term $PM_{2.5}$ health risks. Of the 11 samples collected, two samples exceeded the short-term marginal MEG and five samples exceeded the short-term negligible MEG. No samples exceeded the short-term critical MEG. Likewise, ten samples exceeded the long-term negligible MEG and five samples exceeded the long-term marginal MEG.

2.5 Airborne Metals from PM_{10} and $PM_{2.5}$

2.5.1 Sample data/Notes:

One valid PM_{10} and eleven valid $PM_{2.5}$ airborne metal samples were collected at FOB Delaram II and vicinity from 2010-2011, and 2013. There were no sampling data for 2009, 2012, and 2014.

2.5.2 Short-term and long-term health risks:

The data quantity was insufficient to characterize the potential short- and long-term health risks from PM_{10} and $PM_{2.5}$ airborne metals exposure to U.S. personnel.

2.6 Volatile Organic Compounds (VOC)

2.6.1 Sample data/Notes:

There were no VOC samples collected at any of the basecamps/locations.

2.6.2 Short-term and long-term health risks:

There were no samples available to characterize the potential short- and long-term health risks from VOCs exposure to U.S personnel.

3 Soil

3.1 Site-Specific Sources Identified

3.2 Sample data/Notes:

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). For the risk assessment, personnel are assumed to remain at this location for 6 months to 1 year.

Delaram District Center: A total of three valid surface soil samples were collected with two samples collected on 9 November 2009 and one sample collected on 22 November 2011 to assess OEH health risk to deployed personnel. The sampling locations included a fuel point, burn pit, and water treatment point. The percent of the population exposed to soil and associated dust in the sampled areas ranged between 0 and 25%. No chemicals were detected above the 1 year negligible MEGs. There were no valid soil samples collected at the other basecamps/locations.

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:
The data quantity was insufficient to characterize the potential long-term health risks from soil exposure to U.S. personnel. However, based on the available valid samples, no parameters exceeded the 1-year Negligible MEGs.

4 Water

In order to assess the health risk to U.S. personnel from exposure to water in theater, the most probable exposure pathways were identified. These are based on the administrative information provided on the field data sheets submitted with the samples taken over the time period being evaluated. It is assumed that 100% of all U.S. personnel at FOB Delaram II and vicinity will be directly exposed to disinfected fresh bulk water and untreated water since this classification of water is reportedly used for personal hygiene, showering, and cooking. An expeditionary water packaging system (EWPS) was in operation at FOB Delaram II between 2010 and 2012. A reverse osmosis water purification unit (ROWPU) was in operation at Delaram District Center and at FOB Delaram II prior to transitioning to Delaram II AP. There were three wells located on FOB Delaram II. Wells also existed at Delaram AUP, Delaram District Center, and KDLE PB and were used as sources of disinfected non-potable fresh bulk water. Field data sheets indicate that bottled water was the only approved source of drinking water at all the installations with the exception of FOB Delaram II where EWPS produced water was used for drinking purposes after ROWPU filtration.

4.1 Drinking Water: Bottled or Packaged Water

4.1.1 Site-Specific Sources Identified

4.1.2 Sample data/Notes:
FOB Delaram II: There were four treated water samples collected from the EWPS. Water produced from the EWPS was used for drinking purposes. These samples were collected on 4 November 2010, 5 November 2010, 1 December 2011, and 9 June 2012.

4.1.3 Short-term and long-term health risks:
All parameters detected in the samples collected during the period of EWPS operations at FOB Delaram II were below the short and long-term Negligible MEGs.

4.2 Non-Drinking Water:

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.

4.2.2 Sample data/Notes:
To assess the potential for adverse health effects to troops the following assumptions were made about dose and duration: All U.S. personnel at this location were expected to remain at this site for approximately 1 year. A conservative (protective) assumption is that personnel routinely consumed less than 5 liters per day (L/day) of non-drinking water for up to 365 days (1-year). It is further assumed that control measures and/or personal protective equipment were not used. Six other treated water samples were collected at the location prior to and after the EWPS was in operation. According to Field Data Sheets, this water was not used for drinking and was treated by ROWPU. There was no sampling date for ANP Station, PB Deh Mezong, Delaram AUP, Delaram VSSP, and PB KDLE.

FOB Delaram II: Five disinfected bulk water (non-drinking) samples and three untreated bulk water (non-drinking) samples were collected between 1 March 2010 and 23 September 2010 and were evaluated for this health risk assessment. None of the detected chemicals exceeded the 7-day, 14-day, and 1-year negligible MEG concentrations for a 5-liter intake. It was discovered in the annual visit by Preventive Medicine in June 2013 that all water used for hygiene and showering between June 2012 and June 2013 was untreated. Samples taken at that time at various locations were positive for fecal coliform suggesting personnel assigned to the camp may have been at risk of contracting a waterborne disease/illness if this water was consumed, while the hygiene and shower water was untreated. There was no documentation of waterborne disease/illness at the basecamps/locations.

Delaram II AP: One disinfected bulk water (non-drinking) sample and one untreated water sample were collected respectively on 11 March 2014 and 20 June 2013.

Delaram District Center: Two disinfected bulk water (non-drinking) samples were collected on 9 November 2009 and 20 April 2010. Three untreated bulk water samples were collected on 19 October 2009 (two samples) and 22 November 2011 (one sample).

4.2.3 Short-term and long-term health risks:
No parameters exceeded the short- and long-term MEGS in the samples available.

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 the 1 October 2009 to 31 May 2014 timeframe (References 1 and 5).

5.2 Depleted Uranium (DU)

No specific hazard sources were documented in the DOEHRS or MESL from the 1 October 2009 to 31 May 2014 timeframe (References 1 and 5).

5.3 Ionizing Radiation

No specific hazard sources were documented in the DOEHRS or MESL from the 1 October 2009 to 31 May 2014 timeframe (References 1 and 5).

5.4 Non-Ionizing Radiation

There were several sources of non-ionizing radiation at FOB Delaram II and vicinity. There were multiple communication antennas and satellite dishes located throughout the camp, as well as Counter Remote Control Improvised Explosive Device (CIED) Electronic warfare (CREW) Systems in the convoy vehicles and possibly soldier backpacks. Available documentation did not identify any non-ionizing radiation related injuries.

Short-term and long-term health risks: Low, with a medium confidence level.

6 Endemic 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 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. Effective host nation disease surveillance does not exist within the country. Only a small fraction of diseases are identified or reported in host nation personnel. Diarrheal diseases are expected to temporarily incapacitate a very high percentage of U.S. personnel within days if local food, water, or ice is consumed. Hepatitis A and typhoid fever infections typically cause prolonged illness in a smaller percentage of unvaccinated personnel. Vaccinations are required for DoD personnel and contractors. In addition, although not specifically assessed in this document, significant outbreaks of viral gastroenteritis (e.g., norovirus) and food poisoning (e.g., *Bacillus cereus*, *Clostridium perfringens*, *Staphylococcus*) may occur. Key disease risks are summarized below:

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

6.1.1 Diarrheal diseases (bacteriological)

High, mitigated to Low: Diarrheal diseases are expected to temporarily incapacitate a very high percentage of personnel (potentially over 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

High, mitigated to Low: Unmitigated health risk to U.S. personnel was high year round. U.S. Personnel did not drink untreated water, and vaccination for Hepatitis A is required for deployment into the CENTCOM Area of Responsibility (AOR). Hepatitis A typically occurs after consumption of fecally contaminated food or water or through direct fecal-oral transmission under conditions of poor hygiene

and sanitation. Field conditions (including primitive sanitation, lack of hand washing) may facilitate outbreaks driven by person-to-person spread. A typical case involves 1 to 3 weeks of debilitating symptoms, sometimes initially requiring inpatient care; recovery and return to duty may require a month or more.

6.1.3 Typhoid/paratyphoid Fever

High, mitigated to Low: Unmitigated health risk to U.S. personnel was high year round. Risk was typically highest following spring floods. Typhoid and paratyphoid fever are acquired through the consumption of fecally contaminated food or water. The two diseases are clinically similar, and in areas where they are endemic, typhoid typically accounts for 90 percent of cases. Asymptomatic carriers are common with typhoid and contribute to sustained transmission. In countries with a mixture of primitive and modern sanitation and hygiene, outbreaks of typhoid fever can occur and may involve all age groups. A small number of cases (less than 1% per month attack rate) could occur among unvaccinated personnel consuming local food, water, or ice. With appropriate treatment, typhoid and paratyphoid fever are debilitating febrile illnesses typically requiring 1 to 7 days of supportive care, followed by return to duty.

6.1.4 Diarrhea - protozoal

Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate year round. In general, *Cryptosporidium* spp., *Entamoeba histolytica*, and *Giardia lamblia* were the most common protozoal causes of diarrhea wherever sanitary conditions were significantly below U.S. standards. A small number of cases (less than 1% per month attack rate) could occur among personnel consuming local food, water, or ice. Outbreaks affecting a higher percentage of personnel were possible with *Cryptosporidium*. Symptomatic cases may vary in severity; typically mild disease demonstrating recovery and return to duty in less than 72 hours with appropriate therapy; severe cases may require 1 to 7 days of supportive care, followed by return to duty.

6.1.5 Brucellosis

Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate year round. Brucellosis is a common disease in cattle, sheep, goats, swine, and some wildlife species in most developing countries. Humans contract brucellosis through consumption of contaminated dairy products (or foods made with such products) or by occupational exposures to infected animals. The health risk from direct animal contact was likely to be highest in rural areas where livestock were present. The health risk from contaminated dairy products exists countrywide, including urban areas. Rare cases (less than 0.1% per month attack rate) could occur among personnel consuming local dairy products or having direct contact with livestock. With appropriate treatment, brucellosis is a febrile illness of variable severity, potentially requiring inpatient care; convalescence is usually over 7 days even with appropriate treatment.

6.1.6 Diarrhea - cholera

Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate year round. Development of symptomatic cholera requires exposure to large inoculums and typically is associated with ingestion of heavily contaminated food or water. Person-to-person spread of cholera occurs very infrequently, if at all. The majority of infections (75 percent or more, depending on biotype) among healthy adults are very mild or asymptomatic. Only a small percentage of infections are severe. Because cholera frequently causes serious public health impact, cholera cases are more likely to be reported under the International Health Regulations than other types of diarrhea. Rare cases (less than 0.1% per month attack rate) could occur among personnel consuming local food, water, or ice. Most symptomatic cases are mild, with recovery and return to duty in less than 72 hours on appropriate outpatient treatment; severe cases may require 1-7 days of supportive or inpatient care, followed by return to duty.

6.1.7 Hepatitis E

Moderate, mitigated to Low: Unmitigated health risk to U.S. personnel was moderate year round. Risk was typically highest following spring floods. Hepatitis E occurs in four major genotypes. Genotypes 1 and 2, found primarily in Africa and Asia, cause large numbers of sporadic cases, as well as large outbreaks. Fecal contamination of drinking water is the most common source of exposure for these genotypes. Large outbreaks are usually associated with particularly severe breakdowns in baseline sanitation, as often occurs during heavy rainfall which increases mixing of sewage and drinking water sources. Secondary household cases from person-to-person transmission are uncommon. Unlike hepatitis A, where local populations living in poor sanitary conditions were usually highly immune from childhood exposures, immunity levels for hepatitis E were often much lower, even in areas of extremely poor sanitation. Typically, outbreaks of hepatitis E occur primarily among adults. Although data are insufficient to assess potential disease rates, we cannot rule out rates approaching 1 percent per month among personnel consuming local food, water, or ice. Rates may exceed 1 percent per month for personnel heavily exposed during outbreaks in the local population. Typical case involves 1 to 3 weeks of debilitating symptoms, sometimes initially requiring inpatient care; recovery and return to duty may require a month or more.

6.1.8 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, Pakistan and some African countries. 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 1 to 2 weeks after symptoms appear. The virus can live in an infected person’s feces for many weeks. About 90% of people infected have no symptoms, and about 1% 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.

6.1.9 Short-term health risk:

Low: The overall unmitigated short-term risk associated with food borne 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.

6.1.10 Long-term health risk:

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

High, mitigated to Low: Potential unmitigated risk to U.S. personnel was high during warmer months (typically April through November) but reduced to low with mitigation measures. 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 1 to 7 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 unmitigated disease risk was moderate during the warmer months when sandflies are most prevalent, but reduced to low with mitigation measures. Leishmaniasis is transmitted by sand flies. There are two forms of the disease; cutaneous (acute form) and visceral (a more latent form of the disease). The leishmaniasis parasites may survive for years in infected individuals and this infection may go unrecognized by physicians in the U.S. when infections become symptomatic years later. Cutaneous infection is unlikely to be debilitating, though lesions may be disfiguring. Visceral leishmaniasis disease can cause severe febrile illness which typically requires hospitalization with convalescence over 7 days.

6.2.3 Crimean-Congo hemorrhagic fever

Moderate, mitigated to Low: Unmitigated risk was moderate, but reduced to low with mitigation measures. Crimean-Congo hemorrhagic fever occurs in rare cases (less than 0.1% per month attack rate in indigenous personnel) and is transmitted by tick bites or occupational contact with blood or secretions from infected animals. The disease typically requires intensive care with fatality rates from 5% to 50%.

6.2.4 Sandfly fever

Moderate, mitigated to Low: Unmitigated health risk was moderate with potential disease rates from 1% to 10% per month under worst case conditions. Mitigation measures reduced the risk to low. The disease is transmitted by sandflies and occurs more commonly in children though adults are still at risk. Sandfly fever disease typically results in debilitating febrile illness requiring 1 to 7 days of supportive care followed by return to duty.

6.2.5 Plague

Low: Potential unmitigated health risk to U.S. personnel was 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% per month attack rate) could occur. Incidence could result in potentially severe illness which may require more than 7 days of hospitalization and convalescence.

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

Moderate, mitigated to Low: Potential health risk to U.S. personnel was 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%) in groups of personnel exposed to heavily infected "mite islands" in focal areas. The disease can cause debilitating febrile illness typically requiring 1 to 7 days of inpatient care, followed by return to

duty.

6.2.7 West Nile fever
Low: Unmitigated health risk to U.S. personnel was low with seasonal transmission (March-November). 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.

6.2.8 Short -term health risk:
Low: The unmitigated health risk estimate was high (malaria), moderate (leishmaniasis-cutaneous (acute), Crimean-Congo hemorrhagic fever, sandfly fever, typhus-miteborne); to low (plague, 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.

6.2.9 Long-term health risk:
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* 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.

6.3.2 Short-term health risk:
Low: The overall short-term unmitigated health risk associated with water contact diseases at FOB Delaram II and vicinity was considerate moderate (for leptospirosis) during warmer months. Mitigation measures reduce the risk to low. Confidence in the health risk estimate is high.

6.3.3 Long-term health risk:
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. The Army Surgeon General has defined increased risk in deployed Soldiers as indoor exposure to locals or third country nationals of greater than one hour per week in a highly endemic active TB region. Additional mitigation included active case isolation in negative pressure rooms, where available.

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 risk:
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 risk:
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 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 (>99%) of persons who develop rabies disease will do so within a year after a risk exposure, there have been rare reports of individuals presenting with rabies disease up to six years or more after their last known risk exposure. Mitigation strategies included command emphasis of CENTCOM GO 1B, reduction of

animal habitats, active pest management programs, and timely treatment of feral animal scratches/bites.

6.5.2 Q-Fever
Moderate, mitigated to Low: 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.

6.5.3 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.

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

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

7 Venomous Animal/Insects

All information was taken directly from the Clinical Toxinology Resources web site from the University of Adelaide, Australia (Reference 8). The species listed below have home ranges that overlap the location of FOB Delaram II and vicinity, and may present a health risk if they are encountered by personnel. See Section 10.4 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 afghanus, Orthochirus bicolor, Orthochirus. Jalalabadensis, Orthochirus pallidus, Orthochirus samrchelsis*, and *Orthochirus scrobiculosus*: 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.

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

7.3 Snakes

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

- *Echis multisquamatus* (central Asian saw-scaled viper), *Echis sochureki* (Sochurek's saw-scaled viper), *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 obtuse* (Levantine Viper): Severe envenoming possible, potentially lethal. Bites may cause mild to severe local effects, shock & coagulopathy.

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

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

7.4 Short-term health risk:
Low: If encountered, effects of venom 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 4, Table 3-6).

7.5 Long-term health risk:
None identified.

8 Heat/Cold Stress

8.1 Heat

Nimruz province has a desert climate characterized by low rainfall and a large variation in temperature between day and night. Dry weather and lack of cloud cover allows more solar radiation to reach the surface, accounting for high summer temperatures. Summer conditions last from April-October. During

the summer months it is extremely hot and dry with temperature generally from 86 degrees Fahrenheit (°F) to 108°F. Peak temperatures have occasionally been as high as 130°F in June and July. Summers are known for the "Winds of 120 Days". These heavy trade winds batter the region from May–September. During this period, winds can reach hurricane force, kicking up massive dust storms. The health risk of heat stress/injury based on temperatures alone is low (< 78 °F) from November – March, moderate (78-81.9°F) for October and April, and high (82-87.9°F) from May to September. However, work intensity and clothing/equipment worn pose greater health risk of heat stress/injury than environmental factors alone (Reference 9). 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.

8.1.1 Short-term health risk:
Moderate, 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 low. 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 occurs from November-April. During the winter months, there are variations in temperature of 40°F between daytime and nighttime lows. Winters are colder than the typical subtropical dry zone with temperature from 39°F to 59°F. Temperatures are often below freezing in January. 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 November – April. The risk assessment for Non-Freezing Cold Injuries (NFCI), such as chilblain, trench foot, and hypothermia, is moderate based on historical temperature and precipitation data. Frostbite is possible when temperatures drop below freezing. 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.

8.2.1 Short-term health risk:
Moderate, mitigated to Low: The risk of cold injury was reduced to low through preventive measures such as work/rest cycles, proper hydration and nutrition. Confidence in the health risk estimate is low.

8.2.2 Long-term health risk:
Low: The health risk of cold injury is Low. Confidence in the health risk estimate is high.

9 Noise

9.1 Continuous

FOB Delaram II and vicinity had commercial and tactical generators throughout the FOB.

Short-term and long-term risks: **Low**. The unmitigated health risk was high for individuals working near major noise sources without proper hearing protection. Risk was reduced to low through use of proper hearing protection. Confidence in risk estimate was medium.

9.2 Impulse

No specific hazard sources were documented in the DOEHRS or MESL from the 1 October 2009 to 31 May 2014 timeframe.

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

Burn pits were in operation at PB Deh Mezong, Delaram AUP, Delaram District Center, FOB Delaram II, and PB KDLE. There was no burn pit in operation at Delaram VSSP and Delaram II AP and there is no information concerning burn pits for ANP Station. The Afghan National Army operated the same burn pit previously run by U.S. Forces on FOB Delaram II. This site was next to Delaram II AP. The ANA burn pit reportably operated daily and there was no regulation of the materials burned. Identified materials included metals, wood, aerosol cans, foams, plastics, uniform items, HAZMAT, food, construction debris, and metal Hesco wires. Medical and hazardous wastes from U.S. basecamps were reportedly shipped to Camp Leatherneck for disposal. FOB Delaram II had a grey water pond located outside the perimeter. The other installations in this study had contracts for hauling gray and black water off-site. Wag bags were reportedly used at Delaram District Center for collecting human fecal waste.

10.3 Fuel/petroleum products/industrial chemical spills

The DOEHRS and MESL databases were searched for any information on this topic. Reports identified fuel spills throughout the basecamps. However, information was not available on whether the spills were remediated.

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. There are a pesticide application reports in the MESL data portal for Delaram District Center (aka Delaram) for time period between October 2009 and December 2010 and for FOB Delaram II between the time period of April 2010 and April 2012. 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). The other installations were not provided contract pest control support.

10.4.1 Rodenticides
Rodenticides used to control rodents at Delaram District Center and FOB Delaram II were bromadiolone and brodifacoum. Rodenticide usage information for the other basecamps was not available.

10.4.2 Insecticides
Insecticides used to control ants, bed bugs, flies, mosquitoes, and spiders include: ß-cyfluthrin, *Bacillus thuringiensis* subspecies *israelensis*, pyrethrins, piperonyl butoxide, imidacloprid, Z-9 tricosene, and hydramethylnon. Insecticide usage information for the other basecamps was not available.

Insecticides used to control flies at Delaram District Center and FOB Delaram II include: imidacloprid, methomyl, polybutylenes, polyisobutylenes, and Z-9 tricosene.

10.4.3 Short-term and long-term health risks:
No specific hazard sources were documented in the DOEHRS or MESL from the 1 October 2009 to 31 May 2014 timeframe.

10.5 Asbestos

No specific hazard sources were documented in the DOEHRS or MESL from the 1 October 2009 to 31 May 2014 timeframe.

10.6 Lead Based Paint

No specific hazard sources were documented in the DOEHRS or MESL from the 1 October 2009 to 31 May 2014 timeframe.

10.7 Burn Pit

There were burn pits at PB Deh Mezong, Delaram AUP, Delaram District Center, FOB Delaram II, and PB KDLE. Information related to burn pits was not available for ANP Station. The Afghan National Army operated the same burn pit previously run by U. S. forces on FOB Delaram II. The site was next to Delaram II AP. The ANA burn pit reportedly operated daily and there was no regulation of the materials burned. Identified materials included metals, wood, aerosol cans, foams, plastics, uniform items, HAZMAT, food, construction debris, and metal Hesco wires. Prevailing winds blew the smoke from the ANA camp over Delaram II AP frequently. There were no burn pits operating at Delaram VSSP or Delaram II AP. Air samples were not collected near the burn pits. Short- and long-term health risks could not be assessed.

While not specific to FOB Delaram II 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 10). The Institute of Medicine committee's (Reference 10) 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 U.S. 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]

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) 0028-07, Procedures for Deployment Health Surveillance, 2007.

4. USAPHC TG230, June 2013 Revision, Final Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel TG230.

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

6. Modification 12 to United States Central Command Individual Protection and Individual Unit Deployment Policy, 2 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. Clinical Toxinology Resources: http://www.toxinology.com/. University of Adelaide, Australia.

9. 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.

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

[1] NOTE. The data are currently assessed using the 2013 TG230. The general method involves an initial review of the data which eliminates all chemical substances not detected above 1-yr negligible MEGs. Those substances screened out are not considered acute or chronic health hazards so are not assessed further. For remaining substances, acute and chronic health effects are evaluated separately for air water (soil is only evaluated for long term risk). This is performed by deriving separate short-term and long term population exposure level and estimates (referred to as population exposure point concentrations (PEPC)) that are compared to MEGs derived for similar exposure durations. If less than or equal to negligible MEG the risk is Low. If levels are higher than negligible then there is a chemical-specific toxicity and exposure evaluation by appropriate SMEs, which includes comparison to any available marginal, critical or catastrophic MEGs. For drinking water 15 L/day MEGs are used for the screening while site specific 5-15 L/day are used for more detailed assessment. For nondrinking water (such as that used for personal hygiene or cooking) the 'consumption rate' is limited to 2 L/day (similar to the EPA) which is derived by multiplying the 5 L/day MEG by a factor of 2.5. This value is used to conservatively assess non drinking uses of water.

12 Where Do I Get More Information?

If a provider feels that the Service member's or Veteran's current medical condition may be attributed to specific OEH exposures at this deployment location, he/she can contact the Service-specific organization below. Organizations external to DoD should contact Deputy Assistant Secretary of Defense for Health Readiness Policy and Oversight (HRP&O).
Army Public Health Center (Provisional) (APHC 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