Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Camp Leatherneck and vicinity, Afghanistan
Calendar Years: (2007 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 Camp Leatherneck and vicinity that includes: Camps Leatherneck (Tombstone); Barber; Viking, ABC, Achabeti; Afghan national Police (ANP) Hill; Antonik; Aries 2; Badger; Bishop; Bolan; Boldak; Bouresches; Calero (Shorbak); Chosin; Dangar; Daytona; Delmar; Didgori; Duluth; Edinburgh; Eiffel; El Haam; El Paso; Enguri; Eredvi; Ertoba; Faizel; Fulod (Fulad Sangin Fulod); Gettysburgh; Habib; Hanson (Sher Wali); Honeycutt; Januup; Juno; Kelly; Kems Bazaar; Khalil; Kopp; Kodori; Kunjik; Lambadand (Lamba Dand); Lazika; Mahafiz; Marjah (Marjeh); Maywand; Mehraj; Meis (Ward); Moose; Musa Qualah District Center (DC) (Musa Qal'ah DC, Musa Qa'leh); Orbi; Ouellette (Padnick); Musa Qualah (Mirage); Palacio; Paserlay; Pleiku; Price (Provincial Supply Point (PSP) North); Qurta; Reilly; Sacramento; Saenz; Said Abdul Khalil; Saipan; Shar Ghazay (Shir Ghazy); Shukvani; Shurakay; Silab; Sommerville; Wakil Wazir; and Tarbett; Patrol Bases (PB) 7171; Azziz Ullah; Bandini; Beatley; Beirut; Camel; Compton; Deh Karez; Dehanna Station; Detroit; Garrett; Grand Rapids; Griffin; Grosse Pointe; Judge; Khearse; Kimmel; Kunjak; Lakeside; Lambert; Long Beach; Mahar; Mcelhiney; Muller; Hue City; Reading (Tulsa); Rogers; Salaam Bazaar; Salaor Lara; San Jose; Savannah; Shanfield; Sockalosky; Sofla; South Boston; Talibjan; Tijuana; Troy; Typhoon 3; Typhoon 4; Typhoon 5; Wilson; and Zaehringer; and Combat Outposts (COP) Ape Marcie; Azadi; Coutu; Dakota; Himal; Huskers; Mangal (Mangool); Now Zad (Caferetta); Padlek; Panda Ridge; Afghanistan Police Provincial Police Headquarters (AP PPHQ); Seattle; Shamal District Center; and Yazzie. It presents a qualitative summary of health risks identified at these locations and their potential medical implications. The report is based on information collected from 18 August 2007 through 24 June 2014 from Camp Leatherneck and vicinity 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. Because Camps Leatherneck (Tombstone), Bastion, Barber and Viking were previously covered in Camp Bastion 2006 – 2009 POEMS, the OEH risk assessments for these camps are based on information collected from 30 December 2009 through 24 June 2014.

This assessment assumes that environmental sampling at Camp Leatherneck and vicinity during this period was performed at representative exposure points selected to characterize health risks at the *population–level*. Due to the nature of environmental sampling, the data upon which this report is based may not be fully representative of all the fluctuations in environmental quality or capture unique occurrences. While one might expect health risks pertaining to historic or future conditions at this site to be similar to those described in this report, the health risk assessment is limited to 18 August 2007 through 24 June 2014.

The POEMS can be useful to inform healthcare providers and others of environmental conditions experienced by individuals deployed to Camp Leatherneck and vicinity during the period of this assessment. However, it does not represent an individual exposure profile. Individual exposures depend on many variables such as; how long, how often, where and what someone is doing while working and/or spending time outside. Individual outdoor activities and associated routes of exposure are extremely variable and cannot be identified from or during environmental sampling. Individuals who sought medical treatment related to OEH exposures while deployed should have exposure/treatment noted in their medical record on a Standard Form (SF) 600 (Chronological Record of Medical Care).

SITE DESCRIPTION:

Camp Leatherneck and vicinity is located in the Helmand province. Camp Bastion is the main British outpost in Afghanistan and was established in April 2006. The base is divided into two main parts, Bastion 1 and Bastion 2, and is adjoined to Camp Leatherneck (formerly Camp Tombstone) and the Afghan National Army Camp Shorabak. Bastion 2 includes two tenant camps, Camp Barber and Camp Viking. The remaining sites included in this POEMS are located in the vicinity of Camp Leatherneck. Potential environmental contamination sources may include wind-blown sand, commercial industry, agricultural and vehicle emissions. Typical military operations, including exhaust from vehicles, aircraft and generators, fueling operations, and other local sources including burning of waste (incinerator and burn pit) will also contribute to the ambient environment at these locations.

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 Leatherneck and vicinity. As indicated in the detailed sections that follow Table 2, controls established to reduce health risk were factored into this assessment. In some cases, e.g. ambient air, specific controls are noted, but not routinely available/feasible.

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

Short-term health risks & medical implications:

The following hazards may be associated with potential acute health effects in some personnel during deployment at Camp Leatherneck and vicinity that includes: Camps Leatherneck (Tombstone); Barber; Viking, ABC, Achabeti; Afghan national Police (ANP) Hill; Antonik; Aries 2; Badger; Bishop; Bolan; Boldak; Bouresches; Calero (Shorbak); Chosin; Dangar; Daytona; Delmar; Didgori; Duluth; Edinburgh; Eiffel; El Haam; El Paso; Enguri; Eredvi; Ertoba; Faizel; Fulod (Fulad Sangin Fulod); Gettysburgh; Habib; Hanson (Sher Wali); Honeycutt; Januup; Juno; Kelly; Kems Bazaar; Khalil; Kopp; Kodori; Kunjik; Lambadand (Lamba Dand); Lazika; Mahafiz; Marjah (Marjeh); Maywand; Mehraj; Meis (Ward); Moose; Musa Qualah District Center (DC) (Musa Qal'ah DC); Orbi; Ouellette (Padnick); Musa Qualah (Mirage); Palacio; Paserlay; Pleiku; Price (Provincial Supply Point (PSP) North); Qurta; Reilly; Sacramento; Saenz; Said Abdul Khalil; Saipan; Shar Ghazay (Shir Ghazy); Shukvani; Shurakay; Silab; Sommerville; Wakil Wazir; and Tarbett; Patrol Bases (PB) 7171; Azziz Ullah; Bandini; Beatley; Beirut; Camel; Compton; Deh Karez; Dehanna Station; Detroit; Garrett; Grand Rapids; Griffin; Grosse Pointe; Judge; Khearse; Kimmel; Kunjak; Lakeside; Lambert; Long Beach; Mahar; Mcelhiney; Muller; Hue City; Reading (Tulsa); Rogers; Salaam Bazaar; Salaor Lara; San Jose; Savannah; Shanfield; Sockalosky; Sofla; South Boston; Talibjan; Tijuana; Troy; Typhoon 3; Typhoon 4; Typhoon 5; Wilson; and Zaehringer; and Combat Outposts (COP) Ape Marcie; Azadi; Coutu; Dakota; Himal; Huskers; Mangal (Mangool); Now Zad (Caferetta); Padlek; Panda Ridge; Afghanistan Police Provincial Police Headquarters (AP PPHQ); Seattle; Shamal District Center; and Yazzie:

Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}) from environmental dust and/or burn pits; inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) from environmental dust and/or burn pits; 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 burn pits. 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 April through October, and greater for susceptible persons including those older than 45, of low fitness level, unacclimatized, or with underlying medical conditions. Risks from heat stress may have been reduced with preventive medicine controls, work-rest cycles, proper hydration and nutrition, and mitigation.

Air quality: For inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}), the PM_{10} overall short-term risk was 'Low to High.' For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$), the $PM_{2.5}$ overall short-term risk was 'Low to Moderate.' However, 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. For burn pits, the PM10 overall short-term risk was 'Low to Moderate'at PB Wilson; however, the PM_{10} overall short-term risk was not evaluated at other Camp Leatherneck and vicinity burn pits due to 'no available data.' For burn pits, $PM_{2.5}$ were not evaluated due to 'no or insufficient data available for $PM_{2.5}$ at burn pits located at Camp Leatherneck and vicinity' - see Section 10.7. For burn pits that operated from 18 August 2007 through 24 June 2014, exposures may vary, and exposure to high levels of PM_{10} and to $PM_{2.5}$ in the smoke may also result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups while at this site. Although most short-term health effects from exposure to particulate matter and burn pit smoke should have resolved post-deployment, providers should be prepared to consider the relationship between deployment exposures and current complaints. Some individuals may have sought treatment for acute respiratory irritation during their time at Camp Leatherneck and vicinity. Personnel who reported with symptoms or required treatment while at this site should have exposure and treatment noted in medical record (e.g., electronic medical record and/or on a Standard Form (SF) 600 (Chronological Record of Medical Care).

Long-term health risks & medical implications:

The following hazards may be associated with potential chronic health effects in some personnel during deployment at Camp Leatherneck 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 'Moderate.' 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 area is a dusty desert environment, and conditions may have varied. In addition, for burn pits, the long-term risk for $PM_{2.5}$ was not evaluated due to 'no or insufficient data available for $PM_{2.5}$ at burn pits located at Camp Leatherneck and vicinity.' For burn pits, PM_{10} was not evaluated for long-term risk due to no available health guidelines. For burn pits, see Section 10.7. However, burn pit exposures may vary, as conditions may have varied. For inhalational exposure to high levels of dust, PM_{10} and $PM_{2.5}$, such as during high winds or dust storms, and for exposure to burn pit smoke, it is considered possible that some otherwise healthy personnel who were exposed for a long-term period to dust and particulate matter could develop certain health conditions (e.g., reduced lung function, cardiopulmonary disease). Personnel with a history of asthma or cardiopulmonary disease could potentially be more likely to develop such chronic health conditions. While the dust and particulate matter exposures and exposures to burn pits are acknowledged, at this time there were no specific recommended, post-deployment medical surveillance evaluations or treatments. Providers should still consider overall individual health status (e.g., any underlying conditions/susceptibilities) and any potential unique individual exposures (such as burn pits/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 Leatherneck 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: Low to High, 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, 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.		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, The short-term risk is Low for peak disinfected and raw water sample concentrations of aldicarb sulfone (Camp Leatherneck), magnesium (Camps Bolan, Leatherneck, Marjah, Musa Qualah DC, Ouellette, and COP Mangal, Shamal District Center), monochloroacetic acid (Camp Leatherneck), silver (Camp Edinburgh), sulfate (Camp Leatherneck, Marjah, Ouellette and COP Mangal, Shamal District Center), and thallium (Camp Bolan). A Low health risk is expected to have little to no in-theater medical resources anticipated for protection and treatment.	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, The short-term risk is Low for peak disinfected and raw water sample concentrations of aldicarb sulfone (Camp Leatherneck), magnesium (Camps Bolan, Leatherneck, Marjah, Musa Qualah DC, Ouellette, and COP Mangal, Shamal District Center), monochloroacetic acid (Camp Leatherneck), silver (Camp Edinburgh), sulfate (Camp Leatherneck, Marjah, Ouellette and COP Mangal, Shamal District Center), and thallium (Camp Bolan). A Low health risk is expected to have little to no in-theater medical resources anticipated for protection and treatment.
	Long-term: None identified based on available sample data.		Long-term: None identified based on available sample 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, polio 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

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
Arthropod Vector Borne	Short-term: Variable; High for malaria Moderate for 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 chemoprophylaxis.	Short-term: Low
	Long-term: Low for Leishmaniasis-visceral infection		Long-term: No data available
Water-Contact (e.g. wading, swimming)	Short-term: Moderate for leptospirosis	Recreational swimming in surface waters not likely in this area of Afghanistan during this time period.	Short-term: Low for leptospirosis
	Long-term: No data available		Long-term: No data available
Respiratory	Short-term: Variable; Moderate for tuberculosis (TB) to Low for meningococcal meningitis.	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, anthrax, Q-fever to Low for 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. *Latrodectus dahlia*) to potentially lethal effects (e.g. *Echis multisquamatus*).	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. *Latrodectus dahlia*) to potentially lethal effects (e.g. *Echis multisquamatus*).
	Long-term: No data available		Long-term: No data available
HEAT/COLD STRESS			
Heat	Short-term: Variable; Risk of heat injury is extremely high for April – October, and Low for all other months.	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 Moderate for April – October and Low for all others.
	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: Low risk of cold stress/injury.	Risks from cold stress reduced with protective measures such as use	Short-term: Low risk of cold stress/injury.
	Long-term: Low; Long-term health		Long-term: Low; Long-term health

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
	implications from cold injuries are rare but can occur, especially from more serious injuries such as frost bite.	of the buddy system, limiting exposure during cold weather, proper hydration and nutrition, and proper wear of issued protective clothing.	implications from cold injuries are rare but can occur, especially from more serious injuries such as frost bite.
Unique Incidents/ Concerns			
Particulate matter less than 10 micrometers in diameter (PM_{10})	Short-term: Low to Moderate at PB Wilson, No data were available for PM_{10} at other Camp Leatherneck and vicinity burn pits. Burn pit exposures may vary, and exposure to high levels of PM_{10} in the smoke may also result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups while at this site.	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 at PB Wilson, No data were available for PM_{10} at other Camp Leatherneck and vicinity burn pits. Burn pit exposures may vary, and exposure to high levels of PM_{10} in the smoke may also result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups while at this site.
	Long-term: No health guidelines		Long-term: No health guidelines
Particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$)	Short-term: No or insufficient data were available for $PM_{2.5}$ at burn pits located at Camp Leatherneck and vicinity. Burn pit exposures may vary, and exposure to high levels of $PM_{2.5}$ in the smoke may also result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups while at this site.		Short-term: No or insufficient data were available for $PM_{2.5}$ at burn pits located at Camp Leatherneck and vicinity. Burn pit exposures may vary, and exposure to high levels of $PM_{2.5}$ in the smoke may also result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups while at this site.
	Long-term: : No or insufficient data were available for $PM_{2.5}$ at burn pits located at Camp Leatherneck and vicinity. Burn pit exposures may vary, and exposure to high levels of $PM_{2.5}$ in the smoke may be associated with some otherwise healthy personnel, who were exposed for a long-term period, 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.		Long-term: : No or insufficient data were available for $PM_{2.5}$ at burn pits located at Camp Leatherneck and vicinity. Burn pit exposures may vary, and exposure to high levels of $PM_{2.5}$ in the smoke may be associated with some otherwise healthy personnel, who were exposed for a long-term period, 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.

[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 Leatherneck 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 OEH sampling data and reports obtained from 18 August 2007 through 24 June 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 at Camp Leatherneck 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 USAPHC/Army Institute of Public Health (AIPH). Where applicable, "None Identified" is used when though a potential exposure is identified, and no health risks of either a specific acute or

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

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 Leatherneck 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 US 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

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

2.2 Particulate matter

Particulate matter (PM) is a complex mixture of extremely small particles suspended in the air. The PM includes solid particles and liquid droplets emitted directly into the air by sources such as: power plants, motor vehicles, aircraft, generators, construction activities, fires, and natural windblown dust. The PM can include sand, soil, metals, volatile organic compounds (VOC), allergens, and other compounds such as nitrates or sulfates that are formed by condensation or transformation of combustion exhaust. The PM composition and particle size vary considerably depending on the source. Generally, PM of health concern is divided into two fractions: particle diameter less than 10 micrometers (PM_{10}) which includes coarse particles, and fine particles diameter 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

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

- Not defined and not available.

- Critical MEG = 600

2.3.2 Sample data/Notes:

Camp Leatherneck and vicinity: A total of 45 valid PM_{10} air samples were collected from 21 February 2010 to 23 January 2014. The range of 24-hour PM_{10} concentrations was 42 µg/m^3 – 867 µg/m^3 with an average concentration of 237 µg/m^3.

2.3.3 Short-term health risks:

Low to High: The short-term PM_{10} health risk assessment is Low for average and High for peak PM_{10} sample concentrations at Camp Leatherneck and vicinity. A Low health risk suggests little to no in-theater medical resources anticipated for protection and treatment of personnel (Reference 4, TG 230 Table 3-2). A High health risk suggests some in-theater medical countermeasures and resources anticipated for personnel. Daily average PM_{10} risk levels at Camp Leatherneck and vicinity show High risk 7%, Moderate risk 4%, Low risk 18%, and the no hazard 71% of the time (Reference 4, Table 11).

The hazard severity was below the negligible MEG (250 µg/m^3 to 420 µg/m^3) for average PM_{10} sample concentrations, and critical for the highest sample concentrations. For exposures at the critical hazard severity level, most if not all personnel experience very notable eye, nose, and throat irritation and respiratory effects. Visual acuity is impaired, as is overall aerobic capacity (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:

Camp Leatherneck and vicinity: A total of 153 valid $PM_{2.5}$ air samples were collected from 20 October 2009 to 24 June 2014. The range of 24-hour $PM_{2.5}$ concentrations was 5 µg/m^3 – 499 µg/m^3 with an average concentration of 66 µg/m^3.

2.4.3 Short-term health risks:

Low to Moderate: The short-term $PM_{2.5}$ health risk assessment is Low for average and Moderate for peak $PM_{2.5}$ sample concentrations at Camp Leatherneck and vicinity. A Low health risk suggests little to no in-theater medical resources anticipated for protection and treatment of personnel (Reference 4, Table 3-2). Whereas a moderate risk for peak $PM_{2.5}$ sample concentrations suggests limited in-theater medical countermeasures and resources may be required for personnel. Daily average $PM_{2.5}$ risk

levels at Camp Leatherneck and vicinity show Moderate risk 1%, Low risk 33%, and the no hazard 66% of the time (Reference 4, Table 11).

The hazard severity was negligible (65 µg/m^3 to 250 µg/m^3) for average $PM_{2.5}$ sample concentrations, and marginal for the highest sample concentrations. For exposures at the negligible hazard severity level, a few personnel may experience notable eye, nose, and throat irritation; most personnel will experience only mild effects. For exposures at the marginal hazard severity level , a majority of personnel will experience notable eye, nose, and throat irritation and some respiratory effects. (Reference 4, Table 3-11).

2.4.4 Long-term health risks:

Moderate: The long-term health risk assessment is Moderate for Camp Leatherneck and vicinity based on average $PM_{2.5}$ sample concentration, and the likelihood of exposure at this hazard severity level. 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 for personnel (Reference 4, Table 3-3). Confidence in the long-term $PM_{2.5}$ health risk assessment is low (Reference 4, Table 3-6).

The hazard severity was marginal (> 65 µg/m^3) at Camp Leatherneck for average $PM_{2.5}$ sample concentration. 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. This guideline is an uncertain screening value - it is not a known health effects concentration. (Reference 4, Table 3-12).

2.5 Airborne Metals

2.5.1 Exposure Guidelines:

2.5.2 Sample data/Notes:

FOB Azziz Ullah: A total of two valid PM_{10} airborne metal samples were collected on 10 June 2011 and 10 October 2012. None of the detected metals were above respective 1 year negligible MEGs.

Camp Faizel: A single valid PM_{10} airborne metals sample was collected on 29 November 2012. No metals were detected.

PB Griffin: A total of six valid PM_{10} airborne metal samples were collected from 28 October 2010 to 9 September 2011. None of the detected metals were above respective 1 year negligible MEGs.

COP Huskers: A single valid PM_{10} airborne metals sample was collected on 8 April 2010. None of the detected metals were above respective 1 year negligible MEGs.

Camp Leatherneck: A total of two valid PM_{10} airborne metal samples were collected on 22 and 23 January 2014. None of the detected metals were above respective 1 year negligible MEGs.

COP Now Zad: A single valid PM_{10} airborne metals sample was collected on 23 October 2012. No metals were detected.

Camp Price: A total of five valid PM_{10} airborne metal samples were collected f from 9 April 2010 to 13 April 2010. None of the detected metals were above respective 1 year negligible MEGs.

PB Wilson: A total of 27 valid PM_{10} airborne metal samples were collected from 21 February 2010 to 18 January 2012. None of the detected metals were above respective 1 year negligible MEGs.

2.5.3 Short- and Long-term health risks:

None identified based on the available sampling data.

2.6 Volatile Organic Compounds (VOC)

2.6.1 Exposure Guidelines:

Short Term (14 day) acrolein (µg/m^3):
- Negligible MEG = 45.9

Long-term (1 year) acrolein (µg/m^3):
- Negligible MEG = 0.137

2.6.2 Sample data/Notes:

FOB Azziz Ullah: A single valid VOC air sample was collected using the EPA TO-17 method on 28 September 2012. None of the detected chemicals were above respective short- or long-term negligible MEGs.

Camp Edinburgh: A single valid VOC air sample was collected using the TO-17 method on 3 October 2010. None of the detected chemicals were above respective short- or long-term negligible MEGs.

PB Griffin: A single valid VOC air sample was collected using the TO-17 method on 4 July 2012. None of the detected chemicals were above respective short- or long-term negligible MEGs.

Camp Leather neck:
- A single valid VOC air sample was collected using the TO-17 method on 28 September 2010. None of the detected VOC chemicals exceeded the short or long-term MEGs.

- A single valid VOC air sample was collected using the EPA TO-15 method on 20 November 2013. Acrolein was detected with a sample concentration of 1.1 ug/m^3. Acrolein sample concentration was below the short-term negligible MEG of 45.9 ug/m^3 and greater than the long-term 1 year negligible MEG of 0.137 ug/m^3. However, data were insufficient to characterize long-term risk.

PB Wilson: A total of 2 valid VOC air samples were collected using the TO-17 method on 23 and 24 February 2010. None of the detected chemicals were above respective short- or long-term negligible MEGs.

2.6.3 Short- and Long-term health risks:

None identified based on the available sampling data.

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, 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.

Camp Leatherneck: See section 10.7 for soil samples taken at burn pit and 14 acre supply burn sites.

PB Azziz Ullah: A single valid surface soil sample was collected on 1 August 2011 to assess OEH health risk to deployed personnel. The percent of the population exposed to soil and associated dust in the sampled areas was > 75%. No chemicals were detected above respective 1 year negligible MEGs.

Camp Kelly: A total of 3 valid surface soil samples were collected on 6 June 2011 to assess OEH health risk to deployed personnel. The percent of the population exposed to soil and associated dust in the sampled areas was > 75% for all samples. No chemicals were detected above respective 1 year negligible MEGs.

PB Griffin: A single valid surface soil sample was collected on 9 April 2012 to assess OEH health risk to deployed personnel. The percent of the population exposed to soil and associated dust in the sampled areas was 50 > 75%. No chemicals were detected above respective 1 year negligible MEGs.

Camp Sher Wali: A total of 4 valid surface soil samples were collected on 10 June 2011 and 2 July 2012 to assess OEH health risk to deployed personnel. The percent of the population exposed to soil and associated dust in the sampled areas was > 75% for all samples. No chemicals were detected above respective 1 year negligible MEGs.

PB Mehraj: See section 10.7 for soil samples taken near the burn pit.

Camp Musa Qualah DC: A total of 4 valid surface soil samples were collected on 18 December 2010 and 17 March 2011 to assess OEH health risk to deployed personnel. The percent of the population exposed to soil and associated dust in the sampled areas was > 75% for all samples. No chemicals were detected above respective 1 year negligible MEG.

Camp Now Zad: A total of 2 valid surface soil samples were collected on 28 October 2010 to assess OEH health risk to deployed personnel. The percent of the population exposed to soil and associated dust in the sampled areas was > 75% for all samples. No chemicals were detected above respective 1 year negligible MEG.

Camp Ouellette: A total of 3 valid surface soil samples were collected on 15 May 2011 to assess OEH health risk to deployed personnel. The percent of the population exposed to soil and associated dust in the sampled areas was 50 > 75% for all samples. No chemicals were detected above respective 1 year negligible MEG.

Camp Price: A total of 3 valid surface soil samples were collected on 15 April 2010 to assess OEH health risk to deployed personnel. The percent of the population exposed to soil and associated dust in the sampled areas was > 75% for all samples. No chemicals were detected above respective 1 year negligible MEG.

PB Wilson: A total of 7 valid surface soil samples were collected from 26 February 2010 to 19 November 2012 to assess OEH health risk to deployed personnel. The percent of the population exposed to soil and associated dust in the sampled areas was 25 > 50% for two samples, 50 > 75% for two samples and > 75% for 3 samples. No chemicals were detected above respective 1 year negligible MEG.

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 USAPHC 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. It is assumed that 100% of all U.S. personnel at Camp Leatherneck and vicinity will be directly exposed to reverse osmosis water purification unit (ROWPU) treated, disinfected fresh non-potable 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 only approved source of drinking water.

4.1 Drinking Water: Bottled, Treated or Untreated Water

4.1.1 Site-Specific Sources Identified

4.1.2 Exposure Guidelines:

Aldicarb sulfone
- 14 day negligible MEG = 0.014 milligrams per liter (mg/L)
- 1 year negligible MEG = 0.014 mg/L

Magnesium
- 14 day negligible MEG = 250 mg/L
- 1 year negligible MEG = not available

Monochloroacetic acid
- 14 day negligible MEG = 0.0933 mg/L
- 1 year negligible MEG = 0.28 mg/L

Silver
- 14 day negligible MEG = 0.10 mg/L
- 1 year negligible MEG = 0.10 mg/L

Sulfate (SO_4)
- 14 day negligible MEG = 750 mg/L
- 1 year negligible MEG = not available

Thallium
- 14 day negligible MEG = 0.00327 mg/L
- 1 year negligible MEG = not available

Aldicarb sulfone is a pesticide applied to soil for control of chewing and sucking insects (aphids, whiteflies, leaf miners, soil-dwelling insects), spider mites, and nematodes. Aldicarb sulfone can potentially cause nausea, diarrhea and relatively minor neurological symptoms resulting from acute exposures at levels above the short-term MEG. These effects appear to be rapidly and completely reversible after exposure.

Magnesium is a common naturally occurring alkaline earth metal and an essential dietary mineral. High magnesium concentration in drinking water coupled with high sulfate concentration may have laxative effects.

Monochloroacetic acid is formed from organic material during water chlorination. Monochloroacetic acid is used in research and development laboratories, hospitals, chemical and pharmaceutical preparations, fabric mills, and communication equipment.

Silver occurs in soil mainly in the form of its insoluble and therefore immobile chloride or sulfide. As long as the sulfide is not oxidized to the sulfate, its mobility and ability to contaminate the aquatic environment are negligible. Silver in river water is "dissolved" by complexation with chloride and humic matter. Prolonged exposure to high doses of silver can result in argyria, a benign condition that can cause areas of skin and other tissue to turn gray or blue-gray.

Sulfate is a substance that is often found in drinking water. Available data suggest that people acclimate rapidly to the presence of sulfates in drinking water. However, there are groups within the general population that may be at greater risk from the laxative effects of sulfate when they experience an abrupt change from drinking water with low sulfate concentrations to drinking water with high sulfate concentrations (Reference 6).

Thallium is a metal found in natural deposits such as ores containing other elements. The greatest use of thallium is in specialized electronic research equipment. Thallium can potentially cause gastrointestinal irritation, and peripheral neuropathy from acute exposures at levels above the short-term MEG

4.1.3 Sample data/Notes:

To assess the potential for adverse health effects to troops, the following assumptions were made about dose and duration: A conservative (protective) assumption was that personnel routinely ingested 5 L/day of bottled water for up to 365 days (1-year). It was further assumed that control measures were not used.

PB Aziz Ullah: A total of five treated and untreated water (drinking) samples collected from 23 May 2010 to 13 September 2013 were evaluated for this health risk assessment. No chemicals were detected at levels above respective short or long-term MEGs.

Camp Bastion: A single bottled water (drinking) sample collected on 13 December 2010 was evaluated for this health risk assessment. No chemicals were detected at levels above respective short or long-term MEGs.

Camp Bolan: A total of two treated and untreated water (drinking) samples collected on 29 September 2012 were evaluated for this health risk assessment. Thallium (0.0037 mg/L) was detected in a single treated water sample greater than the short-term 14-day 15 L/day negligible MEG. Magnesium (Peak 34 mg/L, mean 33.5 mg/L) was greater than the short-term 14-day 15 L/day negligible MEG in both samples. However, data were insufficient to characterize risk for typical exposures.

Camp Calero: A single untreated water (drinking) sample collected on 30 September 2011 was evaluated for this health risk assessment. No chemicals were detected at levels above respective short or long-term MEGs.

Camp Coutu: A single untreated water (drinking) sample collected on 29 November 2011 was evaluated for this health risk assessment. No chemicals were detected at levels above respective short or long-term MEGs.

FOB Edinburgh: A total of six treated water (drinking) samples collected from 28 April 2010 to 31 May 2012 were evaluated for this health risk assessment. Silver (0.12 mg/L) was detected in a single water sample greater than the short-term 14-day 15 L/day negligible MEG.

PB Griffin: A single ROWPU treated water (drinking) sample collected on 9 April 2012 was evaluated for this health risk assessment. No chemicals were detected at levels above respective short or long-term MEGs.

Camp Leatherneck: A total of 24 treated and untreated water (drinking) samples collected from 9 January 2010 to 2 January 2014 were evaluated for this health risk assessment. Aldicarb sulfone (Peak 0.022 mg/L, mean 0.0019 mg/L), magnesium (Peak 14 mg/L, mean 2.37 mg/L), monochloroacetic acid (Peak 0.62 mg/L, mean 0.037 mg/L), and sulfate (Peak 292 mg/L, mean 103 mg/L) had a single sample concentration greater than the short-term 14-day 15 L/day negligible MEG.

COP Mangal: A single untreated water (drinking) sample collected on 20 June 2012 was evaluated for this health risk assessment. Magnesium (62 mg/L), and sulfate (300 mg/L) were detected at concentrations greater than the short-term 14-day 15 L/day negligible MEG.

Camp Marjah: A total of five ROWPU treated and untreated water (drinking) samples collected from 7 May 2010 to 12 November 2011 were evaluated for this health risk assessment. Magnesium (Peak 39 mg/L, mean 19.5 mg/L), and sulfate (Peak 330 mg/L, mean 150.6 mg/L) peak sample concentrations were greater than the short-term 14-day 15 L/day negligible MEG.

Camp Musa Qualah DC: A total of three ROWPU treated water (drinking) samples collected from 20 December 2010 to 17 May 2011 were evaluated for this health risk assessment. Magnesium (Peak 32 mg/L, mean 31.3 mg/L) peak and mean sample concentrations were greater than the short-term 14-day 15 L/day negligible MEG. However data were insufficient to characterize risk based on mean sample concentration.

Camp Now Zad: A total of three treated and untreated water (drinking) samples collected from 24 October 2009 and 25 October 2012 were evaluated for this health risk assessment. No chemicals were detected at concentrations above respective short or long-term MEGs.

COP Ouellette: A single untreated water (drinking) sample collected on 14 May 2011 was evaluated for this health risk assessment. Magnesium (73 mg/L), and sulfate (1500 mg/L) were detected at concentrations greater than the short-term 14-day 15 L/day negligible MEG.

Camp Price: A total of two untreated water (drinking) samples collected on 18 August 2007 and 25 January 2010 were evaluated for this health risk assessment. No chemicals were detected at concentrations above respective short or long-term negligible MEGs.

COP Shamal District Center: A single untreated water (drinking) sample collected on 7 September 2007 was evaluated for this health risk assessment. Magnesium (79 mg/L), and sulfate (480 mg/L) were detected at concentrations greater than the short-term 14-day 15 L/day negligible MEG.

Camp Shar Ghazay: A total of three treated and untreated water (drinking) samples collected from 18 July 2011 to 11 June 2013 were evaluated for this health risk assessment. No chemicals were detected at concentrations above respective short or long-term negligible MEGs.

Camp Shukvani: A total of two ROWPU treated water (drinking) samples collected on 24 July 2012 and 22 March 2013 were evaluated for this health risk assessment. No chemicals were detected at concentrations aboverespective short or long-term negligible MEGs.

PB Wilson: A total of 14 ROWPU treated water (drinking) samples collected from 25 February 2010 to 25 February 2014 were evaluated for this health risk assessment. No chemicals were detected at concentrations above respective short or long-term negligible MEGs.

4.1.4 Short-term health risk:

Low. The short-term risk is Low for peak disinfected and raw water sample concentrations of aldicarb sulfone (Camp Leatherneck), magnesium (Camps Bolan, Leatherneck, Marjah, Musa Qualah DC, Ouellette, and COP Mangal, Shamal District Center), monochloroacetic acid (Camp Leatherneck), silver (Camp Edinburgh), sulfate (Camp Leatherneck, Marjah, Ouellette and COP Mangal, Shamal District Center), and thallium (Camp Bolan). A Low health risk is expected to have little to no in-theater medical resources anticipated for protection and treatment. (Reference 4, TG 230 Table 3-2). Confidence in short-term non-drinking water risk assessment is low (Reference 10, Table 3-6).
4.1.4 Long-term health risk:

None identified based on available sample data.

4.2 Non-Drinking Water: Untreated

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 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.

FOB Edinburgh: A single untreated water (non-drinking) sample collected on 6 April 2011 was evaluated for this health risk assessment. No chemicals were detected at levels above the short or long-term MEGs.

4.2.3 Short and long-term health risks:

None identified based on available sample data.

4.2.4 Short and long-term health risks:

None identified based on available sample data.

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 18 August 2007 through 24 June 2014 timeframe (References 1 and 5).

5.2 Depleted Uranium (DU)

No specific hazard sources were documented in the DOEHRS, or MESL from 18 August 2007 through 24 June 2014 timeframe (References 1 and 5).

5.3 Ionizing Radiation

No specific hazard sources were documented in the DOEHRS, or MESL from 18 August 2007 through 24 June 2014 timeframe (References 1 and 5).

5.4 Non-Ionizing Radiation

No specific hazard sources were documented in the DOEHRS, or MESL from 18 August 2007 through 24 June 2014 timeframe (References 1 and 5).

6 Endemic Diseases

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

6.1 Foodborne and Waterborne Diseases

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, typhoid/paratyphoid fever, and diarrhea-protozoal

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

6.1.3 Polio

Low: Potential health risk to U.S. personnel is Low. Despite a concerted global eradication campaign, poliovirus continues to affect children and adults in Afghanistan, 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

6.1.4 Short-term Health Risks:

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.

6.1.5 Long-term Health Risks:

None identified based on available data.

6.2 Arthropod Vector-Borne Diseases

During the warmer months, the climate and ecological habitat support populations of arthropod vectors, including mosquitoes, ticks, mites, and sandflies. Significant disease transmission is sustained countrywide, including urban areas. Malaria, the major vector-borne health risk in Afghanistan, is capable of debilitating a high percentage of personnel for up to a week or more. Mitigation strategies were in place and included proper wear of treated uniforms, application of repellent to exposed skin, and use of bed nets and chemoprophylaxis (when applicable). Additional methods included the use of pesticides, reduction of pest/breeding habitats, and engineering controls.

6.2.1 Malaria

High, mitigated to Low: Potential unmitigated risk to U.S. personnel is 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 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. 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 is 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: Sandfly fever has a Moderate risk 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 resulted in debilitating febrile illness requiring 1 to 7 days of supportive care followed by return to duty.

6.2.5 Plague

Low: Potential health risk to U.S. personnel is Low year round. Bubonic plague typically occurred as sporadic cases among people who come in contact with wild rodents and their fleas during work, hunting, or camping activities. Outbreaks of human plague are rare and typically occur in crowded urban settings associated with large increases in infected commensal rats (*Rattus rattus*) and their flea populations. Some untreated cases of bubonic plague may develop into secondary pneumonic plague. Respiratory transmission of pneumonic plague is rare but has the potential to cause significant outbreaks. Close contact is usually required for transmission. In situations where respiratory transmission of plague is suspected, weaponized agent must be considered. Extremely rare cases (less than 0.01% 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 is Moderate during warmer months (typically March through November) when vector activity is highest. Mitigation measures reduced the risk to low. Mite-borne typhus is a significant cause of febrile illness in local populations with rural exposures in areas where the disease is endemic. Large outbreaks have occurred when non-indigenous personnel such as military forces enter areas with established local transmission. The disease is transmitted by the larval stage of trombiculid mites (chiggers), which are typically found in

areas of grassy or scrubby vegetation, often in areas which have undergone clearing and regrowth. Habitats may include sandy beaches, mountain deserts, cultivated rice fields, and rain forests. Although data are insufficient to assess potential disease rates, attack rates can be very high (over 50%) 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: West Nile fever is present. The disease is maintained by the bird population and transmitted to humans via mosquito vector. Typically, infections in young, healthy adults were asymptomatic although fever, headache, tiredness, body aches (occasionally with a skin rash on trunk of body), and swollen lymph glands can occurred. This disease is associated with a low risk estimate.

6.2.8 Short -term health risks:

Low: The unmitigated health risk estimate is High for malaria (infection rate of less than 1% per month), Moderate for leishmaniasis-cutaneous (acute), Crimean-Congo hemorrhagic fever, sandfly fever, typhus-miteborne; and Low for, the plague and West Nile fever. Health risk 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 risks:

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

6.3 Water Contact Diseases

Operations or activities that involve extensive water contact may result in personnel being temporarily debilitated with leptospirosis in some locations. Leptospirosis health risk typically increases during flooding. In addition, although not specifically assessed in this document, bodies of surface water are likely to be contaminated with human and animal waste. Activities such as wading or swimming may result in exposures to enteric diseases such as diarrhea and hepatitis via incidental ingestion of water. Prolonged water contact also may lead to the development of a variety of potentially debilitating skin conditions such as bacterial or fungal dermatitis. Mitigation strategies were in place and included avoiding water contact and recreational water activities, proper wear of uniform (especially footwear), and protective coverings for cuts/abraded skin.

6.3.1 Leptospirosis

Moderate, mitigated to Low: Human infections occur seasonally (typically April through November) through exposure to water or soil contaminated by infected animals and is associated with wading, and swimming in contaminated, untreated open water. The occurrence of flooding after heavy rainfall facilitates the spread of the organism because as water saturates the environment leptospirosis present in the soil passes directly into surface waters. Leptospirosis 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. 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 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 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 Anthrax

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

6.5.3 Q-Fever

Moderate, mitigated to Low: Potential health risk to U.S. personnel is Moderate, but mitigated to Low, year round. Rare cases are possible among personnel exposed to aerosols from infected animals, with clusters of cases possible in some situations. Significant outbreaks (affecting 1-50%) 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 strategies in place as listed in paragraph 6.5.2 except for vaccinations.

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 risks:

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 risks:

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/Insect

All information was taken directly from the Armed Forces Pest Management Board (Reference 8) and Clinical Toxinology Resources web site from the University of Adelaide, Australia (Reference 9). The species listed below have home ranges that overlap the location of Camp Leatherneck 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.

PB Lakeside: The presence of scorpions, and Asian hornets (*Vespa* spp.) have been noted (Reference 10).

7.1 Spiders

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

7.2 Scorpions

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

- *Buthacus striffleri*, *Compsobuthus afghanus*, *Compsobuthus rugosulus, Mesobuthus caucasicus, Mesobuthus eupeus, Mesobuthus macmahoni, Orthochirus bicolor, Orthochirus danielleae*, *Orthochirus erardi, Orthochirus heratensis, Orthochirus monodi, Orthochirus pallidus, Orthochirus scrobiculosus,* and *Sassanidotus gracilis*: There are a number of dangerous Buthid scorpions, but there are also some known to cause minimal effects only. Without clinical data it is unclear where these species fit within that spectrum.

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

7.3 Snakes

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

- *Eristocophis mcmahoni* (McMahon's Viper): Severe envenoming possible, potentially lethal. Venom shows strong hemorrhagic activity. Mild to Moderate neurotoxic effects may occur.

- *Pseudocerastes persicus* (Persian dwarf snake): Unlikely to cause significant envenoming; limited clinical data suggest bites result in local effects 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., central Asian saw-scaled 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

Summer (June - September) monthly mean daily maximum temperatures range from 95 degrees Fahrenheit (°F) to 108 °F with an average temperature of 104 °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 November – March, 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 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, and Low from November – March. 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

8.2.1 Short-term health risks:

Winter (December - March) mean daily minimum temperatures range from 32 °F to 51 °F with an average temperature of 39 °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 October – 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).

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

8.1.2 Long-term health risk:

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

9 Noise

9.1 Continuous

Flight line personnel are exposed to hazardous noise and are monitored in the Hearing Conservation Program. No other specific hazard sources were documented in the DOEHRS or MESL from 18 August 2007 through 24 June 2014 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 18 August 2007 through 24 June 2014 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 specific hazard sources were documented in the DOEHRS or MESL from 18 August 2007 through 24 June 2014 timeframe.

PB Lakeside: All solid waste, except for hazardous material (HAZMAT) waste is collected on a daily basis from all areas of the camp and is burned daily. No documentation on HAZMAT waste disposal was found. Medical waste is transported to Camp Bastion for disposal at a level III hospital. Grey and black water are disposed in soakage pits (Reference 10, Reference 12).

Camp Leatherneck: Open burn pits were located on the north sides of Camp Bastion and Camp Leatherneck. These burn pits were used for the disposal, reduction and sanitization of domestic, catering and non-hazardous wastes that were generated within Camp Leatherneck and vicinity. Combustible, non-hazardous waste from Coalition units and UK contractors was also disposed of within this facility. Incinerators were also used at the site but on a small scale and were primarily used for medical waste.

PB Mehraj: All solid waste, except for HAZMAT waste is collected on a daily basis from all areas of the camp and is burned in the burn pit daily. No documentation on HAZMAT waste disposal was found. Medical waste is transported to Camp Bastion for disposal at level III hospital. Grey and black water disposed in evaporating soaking pits (Reference 13, Reference 14).

PB Meis: All solid waste, except for HAZMAT waste is collected on a daily basis from all areas of the camp and is burned in the burn pit daily. No documentation on HAZMAT waste disposal was found. Medical waste is transported to Camp Bastion for disposal at level III hospital. Grey and black water disposed in evoporating soaking pits (Reference 15).

Camp Musah Qualah DC: All solid waste, except for HAZMAT waste is collected on a daily basis from all areas of the camp and is burned in the burn pit daily. Medical waste is transported to Camp Bastion for disposal at level III hospital. HAZMAT waste is transported to Camp Leatherneck's HAZMAT yard. Grey and black water disposed in evorapating soaking pits. Grey water is also disposed of in a trench where the evaporation rate is insufficient to preclude standing water, resulting in an entomological concern (Reference 16).

COP Now Zad: Solid waste disposed in burn pit. Medical waste is transported to Camp Bastion for disposal at level III hospital. Used petroleum oils and lubricants (POLs), and batteries are transported to Camp Leatherneck's HAZMAT yard. Grey and black water disposed in evaporating soaking pits (Reference 17).

10.2.1 Short-term and Long-term health risks:

Not evaluated.

10.3 Fuel/petroleum products/industrial chemical spills

No specific hazard sources were documented in the DOEHRS or MESL from 18 August 2007 through 24 June 2014 timeframe.

10.3.1 Short-term and Long-term health risks:

Not evaluated.

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 40 monthly pesticide application reports in the MESL data portal for Camp Leatherneck (May 2010 to September 2013) 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, and zinc phosphide were used to control rodents.

10.4.2 Insecticides

Insecticides used to control ants, beetles, bed bugs, bees, cockroaches, crickets, fleas, flies, mosquitoes, silver fish, spiders, and wasps incude: abamectin B1, *Bacillus thuringiensis subspecies israelensis,* bifenthrin, ß-cyfluthrin, cypermethri, DEET (95%), deltamethrin, d-trans Allethrin, fipronil, hydramethylnon, imidacloprid, lambda-cyhalothrin, malathion, methomyl, n-octyl bicycloheptene dicarboximide, phenothrin, piperonyl butoxide, 1,2-propanediol, pyrethrins, resmethrin, (S)-Methoprene, Trichlorofluoromethane, and (Z)- 9- tricosene.

10.4.3 Short-term and Long-term health risks

Not evaluated.

10.5 Asbestos

No specific hazard sources were documented in the DOEHRS or MESL from December 2009 to 23 January 2014 timeframe.

10.5.1 Short-term and Long-term health risks:

Not evaluated.

10.6 Lead Based Paint

No specific hazard sources were documented in the DOEHRS or MESL from December 2009 to 23 January 2014 timeframe.

10.6.1 Short-term and Long-term health risks:

Not evaluated.

10.7 Burn Pit

PB Aziz Ullah: A burn pit was located on the western perimeter of the PB approximately 400 meters from the logistic support area. PB Aziz Ullah was transferred to the Afghanistan National Army (ANA) on 01 June 2012.

PB Lakeside: A 15 foot (ft) x 20 ft burn pit was located on the east side of the PB near the entry control point (ECP) and operational until PB Lakeside closure on 01 November 2011. All solid waste, except for hazardous material (HAZMAT) was collected on a daily basis from all areas of the camp and was burned daily. Trash is not sorted; all plastic, cardboard, metals and food wastes were burned together. Very limited first aid medical waste was generated. Medical waste was transported to Camp Bastion for disposal (Reference 10, Reference 12).

COP Kelly: Two burn pits are located on the outskirts of the landing zone. COP Kelly was transferred to the ANA on 01 November 2011.

Camp Leatherneck: Open burn pits were located on the north sides of Camp Bastion and Camp Leatherneck. These burn pits were used for the disposal, reduction and sanitization of domestic, catering and non-hazardous wastes that were generated within Camp Leatherneck and vicinity. Combustible, non-hazardous waste from Coalition units and UK contractors was also disposed of within this facility. Covered waste (Reference 18) was sorted and not disposed of within the burn pits. Incinerators were also used at the site but on a small scale and were primarily used for medical waste. Burn pit operations ceased on site in July 2013.

PB Mehraj: All solid waste on base was burned at the burn pit located outside the base perimeter. Trash was collected throuout the camp and burned daily. Trash was not sorted; all plastic, cardboard, metals and food wastes were burned together. Medical waste was transported to Camp Bastion for disposal at level III hospital (Reference 13, Reference 14). The PB Mehraj was transferred to the ANA on 26 December 2011.

PB Meis: Trash was collected daily throughout camp for disposal in the burn pit. Trash was not sorted prior to burning. Burn pit was located near troop living (Reference 15). The PB Meis was transferred to the ANA in October 2011.

Camp Musah Qualah DC: Burn pit located approximately 600 feet from troop living areas and adjacent to ECP. All solid waste on base, except HAZMAT such as medical waste and POLs, were burned in the burn pit. Trash was not sorted prior to burning (Reference 16). Camp Musah Qualah DC was transferred to the ANA in November 2013.

COP Now Zad: All solid waste on base, other than HAZMAT, was burned in the Burn Pit, which was located on the ANA side outside the wire about 60 to 100 yards from troop working and living spaces, or in burn barrels located near the COP's only restroom (Reference 17). The COP Now Zad closed in September 2013.

While not specific to Camp Leatherneck 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 19). The Institute of Medicine committee's (Reference 19) review of the literature and the data suggests that service in Iraq or Afghanistan (i.e., a broader consideration of air pollution than exposure only to burn pit emissions) may be associated with long-term health effects, particularly in susceptible (e.g., those who have asthma) or highly exposed subpopulations, such as those who worked at the burn pit. Such health

effects would be due mainly to high ambient concentrations of PM from both natural and anthropogenic sources, including military sources. If that broader exposure to air pollution turns out to be relevant, potentially related health effects of concern are respiratory and cardiovascular effects and cancer. Susceptibility to the PM health effects could be exacerbated by other exposures, such as stress, smoking, local climatic conditions, and co-exposures to other chemicals that affect the same biologic or chemical processes. Individually, the chemicals measured at burn pit sites in the study were generally below concentrations of health concern for general populations in the United States. However, the possibility of exposure to mixtures of the chemicals raises the potential for health outcomes associated with cumulative exposure to combinations of the constituents of burn pit emissions and emissions from other sources.

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

10.7.1.1 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.

10.7.1.2 Sample data/Notes:

PB Wilson: A total of three valid PM_{10} air samples near the burnpit were collected from 27 April to 11 May 2011. The range of 24-hour PM_{10} concentrations was 690 $\mu g/m^3$ – 914 $\mu g/m^3$ with an average concentration of 836 $\mu g/m^3$. Data were insufficient to characterize risk for average PM_{10} concentrations. However, peak PM_{10} concentration will be evaluated.

10.7.1.3 Short-term health risks:

Low to Moderate: Data were not evaluated for average PM_{10} concentrations at PB Wilson burnpit. The short-term PM_{10} health risk assessment is Moderate for peak PM_{10} sample concentrations near the PB Wilson burnpit. A Low health risk suggests little to no in-theater medical resources anticipated for protection and treatment of personnel (Reference 4, TG 230 Table 3-2). A Moderate risk for peak PM_{10} sample concentration suggests limited in-theater medical countermeasures and resources may be required for personnel.

For peak exposures at the critical hazard severity level, most if not all personnel experience very notable eye, nose, and throat irritation and respiratory effects. Visual acuity is impaired, as is overall aerobic capacity (Reference 4, Table 3-11).

10.7.1.4 Long-term health risk:

Not Evaluated-no available health guidelines. The 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.

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

10.7.2.1 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.

10.7.2.2 Sample data/Notes:

Camp Hanson (Sher Wali): A single valid $PM_{2.5}$ valid air samples near the burnpit was collected on 1 July 2012. The 24-hour $PM_{2.5}$ concentration was 29 µg/m^3. The single sample was insufficient to characterize short- or long-term risk.

10.7.2.3 Short-term health risks:

Not evaluated.

10.7.2.4 Long-term health risks:

Not evaluated.

10.7.3 Airborne Metals

10.7.3.1 Exposure Guidelines:

Short Term (14 day) cadmium (µg/m^3):
- Negligible MEG = 0.0205

Long-term (1 year) cadmium (µg/m^3):
- Negligible MEG = 0.00685

10.7.3.2 Sample data/Notes:

PB Wilson: A total of three valid PM_{10} airborne metal samples near the burn pit were collected from 27 April to 4 May 2011. Cadmium was detected above the 14-day negligible MEG of 0.0205 µg/m^3 and the 1-year negligible MEG of 0.00685 µg/m^3 in a single sample with a concentration of 0.125 µg/m^3. Data were insufficient to characterize short- or long-term risk.

10.7.3.3 Short-term health risks:

Not evaluated.

10.7.3.4 Long-term health risks:

Not evaluated.

10.7.4 Volatile Organic Compounds (VOC)

10.7.4.1 Exposure Guidelines:

10.7.4.2 Sample data/Notes:

PB Wilson: A total of three valid burnpit VOC air samples were collected using TO-17 method from 4 – 10 May 2011. None of the detected chemicals were above respective short- or long-term negligible MEGs.

10.7.4.3 Short-term health risks:

None identified based on the available sampling data.

10.7.4.4 Long-term health risks:

None identified based on the available sampling data.

10.7.5 Soil

10.7.5.1 Exposure Guidelines:

Long-term (1 year) Cadmium (mg/kg):
- Negligible MEG = 104

10.7.5.2 Site-Specific Sources Identified:

10.7.5.3 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, 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).

Camp Leatherneck:

- Burn pit: A total of 20 valid surface soil samples were collected from 16 April 2010 to 10 June 2010, to assess OEH health risk to deployed personnel. Samples were taken after burn pit closure to document possible exposure to personnel. Samples were taken from all four corners and the center of the burn pit. The percent of the population exposed to soil and associated dust in the sampled areas was < 10% for all samples. For the risk assessment, personnel are assumed to remain at this location for 6 months to 1 year. No chemicals were detected with a sample concentration above the 1 year negligible MEG.

- 14 acre supply burn site: A 14 acre burn site was used for the disposal (burning) of equipment and chemicals. A total of 18 valid surface soil samples were collected from perimeter and the center of the fire area after the burning was complete. Soil samples were collected on 3 June 2010. An additional 18 valid surface soil samples were collected 10 August 2010 after hazardous material clean-up mitigation of burn site. Exposure to burn site was limited to personnel on site during fire suppression and area clean up. In the pre-mitigation samples, cadmium had a mean sample concentration of 23 mg/kg and a peak concentration of 348 mg/kg. After mitigation, cadmium was reduced to 1 mg/kg for mean and 21 mg/kg for peak soil sample concentrations.

PB Mehraj burn pit: A total of three valid surface soil samples were collected on 7 May 2011 to assess OEH health risk to deployed personnel. The percent of the population exposed to soil and associated dust in the sampled areas was 50 > 75% for all samples. No chemicals were detected above respective 1 year negligible MEG.

10.7.5.4 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**.**

10.7.5.5 Long-term health risk:

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

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) 0017-12, Procedures for Deployment Health Surveillance, 2012.

4. USA PHC TG230, June 2013 Revision.

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, 3 December 2013.

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

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

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

10. OEHSA. 2011. Observation Post Lakeside Occupational & Environmental Health Site Assessment. Regional Command Southwest Operation Enduring Freedom, June 2011.

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. BCA. 2011. Observation Post Lakeside Base Camp Assessment Team Prevenative Medicine Report. June 2011.

13. OEHSA. 2011. Patrol Base Mehraj Occupational & Environmental Health Site Assessment. Regional Command Southwest Operation Enduring Freedom, June 2011.

[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.

14. BCA. 2011. Patrol Base Mehraj Base Camp Assessment Team Prevenative Medicine Report. June 2011.

15. OEHSA. 2011. Patrol Base Meis Occupational & Environmental Health Site Assessment. Regional Command Southwest Operation Enduring Freedom, June 2011.

16. OEHSA. 2011. Forward Operating Base Musa Qa'leh Occupational & Environmental Health Site Assessment. Regional Command Southwest Operation Enduring Freedom, May 2011.

17. OEHSA. 2011. Combat Outpost Cafferetta/Now Zad Occupational & Environmental Health Site Assessment. Regional Command Southwest Operation Enduring Freedom, May 2011.

18. DoDI 4715.19, Use of Open-Air Burn Pits in Contingency Operations, February 2011.

19. 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 (Provisional) 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 Health Readiness Policy and Oversight (HRP&O) Phone: (800) 497-6261. http://fhpr.dhhq.health.mil/home.aspx