Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Rushmore and vicinity, Afghanistan
Calendar Years: (2003 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 Rushmore and vicinity that includes the 5th Afghan Border Patrol (ABP) Compound, Forward Operating Base (FOB) Boris, Combat Outpost (COP) Curry, FOB Kahyr Kot Castle (Khayor Khot Castle), FOB Kushamond, Camp Margah AB, Camp Mata Khan, COP Munoz, FOB Orgun-E, FOB Rushmore, Camp Sar Howza, Camp Shadi, FOB Sharana (Kearney), Firebase Shkin (Lilley), Super FOB Kahyr Kot Castle, FOB Tillman (Lwara), FOB Wazi Khwa, Camp Yahya Khel (Yosef Kel, Yusef Khel), and COP Zerok. It presents a qualitative summary of health risks identified at this location and their potential medical implications. The report is based on information collected from 01 January 2003 through 31 December 2014 to include deployment OEHS sampling and monitoring data (e.g., air, water, and soil), field investigation and health assessment reports, as well as country and area-specific information on endemic diseases. While the 5th ABP Compound and Camp Shadi are included as locations due to their location in the Paktika Province and proximity to the other sites listed there was no specific site information available for either of these camps.

This assessment assumes that environmental sampling at Rushmore 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 01 January 2003 through 31 December 2014.

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

All 19 locations included in this document were located within the Paktika province of Afghanistan, which is located in the southeastern part of the country. The majority of the province is hilly and interspersed with seasonal river valleys; however there is some mountainous and rugged terrain in parts of the province.

FOB Boris: This FOB was located in a valley within the Paktika province, approximately 10 kilometers (km) south of the town of Burmel. The site was located in an arid region with rocky compacted soil and gavel covered the entire FOB. There were both semi-permanent and permanent structures used on the FOB.

COP Curry: It was located in East Paktika province approximately 28km west of the Pakistan border. This location had a significant grade from all directions; the slope for most of the COP was greater than

five percent. The site was occupied by U.S. and Local forces for approximately four years with the majority of the COP used for life support for U.S. action in the area. The site was situated in a former Afghan hospital complex with stone walls surrounding the exterior section of the base. The structures on the site were a combination of tents, permanent, semi-permanent structures and the roads were, gravel, paved and semi-paved.

FOB Kushamond: This site was located on a plateau, approximately 200 meters (m) above sea level. The area was described as flat, arid, sparsely vegetated and undeveloped. It was surrounded by agriculture on all sides. There were semi-permanent structures located on the site.

Base Camp Margah: This base camp was situated in a rocky mountainous terrain with packed dirt covered with gravel. It was reported that there were a combination of tents, semi-permanent and permanent structures at the site with both unpaved and gravel roads. This site was reported to serve as a mission staging area.

Camp Orgun-E: This camp was situated on flat terrain surrounded on all sides by mountains and the area was covered by small trees and shrubs. The site was originally a Soviet helicopter base and the permanent buildings already on the site were used as office buildings.

Super FOB Khayr Kot Castle (KKC): It was reported that this FOB was situated in a relatively flat area, with a slight slope from one side of the camp to the other and areas to the north, south, and east are mountainous. There were permanent newly constructed structures on the camp used for administrative support, housing and dining areas. There were gravel and paved roads at the site.

FOB Rushmore: This site was located in a relatively flat area with little relief from one side to the other. The majority of the site is covered with a course grade crushed limestone/gravel mix. The structures on the site consisted of wooden B-huts that were used for housing and operations.

FOB Sharana: It was established in late 2001, located south of the town of Sharan, Paktika Province of Eastern Afghanistan. It was a logistics and infantry base supporting several satellites (FOBs) in Regional Command East. FOB Sharana appeared to be about three square miles in size, with a one-mile long runway. There was a combination of tents, semi-permanent and permanent structures used to provide housing for personnel. There was also a combination of paved, unpaved and gravel roads throughout the site. The base camp straddles multiple wadis and ridges, with most of the facilities built upon the ridges. FOB Sharana was at an elevation of 2141 meters (approximately 7000 feet, ft) above sea level and was a barren, arid region with sparse vegetation.

There was not any additional specific camp information available for FOB Kahyr Kot Castle (Khayor Khot Castle), Camp Mata Khan, COP Munoz, Camp Sar Howza, Camp Shadi, Firebase Shkin (Lilley), Super FOB Kahyr Kot Castle, FOB Tillman (Lwara), FOB Wazi Khwa, Camp Yahya Khel (Yosef Kel, Yusef Khel), and COP Zerok.

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 Rushmore 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 Rushmore and vicinity that includes Camp Boris, Camp Curry, FOB Khayr Kot Castle, FOB Kushamond, Firebase Shkin(Lilley), Camp Margah, Camp Mata Khan, Combat Outpost Munoz, FOB Orgun-E, FOB Rushmore, Camp Sar Howza, Camp Shadi, FOB Sharana, Super FOB Khayr Kot Castle, FOB Tillman, FOB Wazi Khwa, Camp Yahya Khel, Camp Yosef Kheyl, Combat Outpost Zerok:

Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}) 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); and heat stress. For food/waterborne diseases (e.g., bacterial diarrhea, hepatitis A, typhoid/paratyphoid fever, diarrhea-cholera, diarrhea-protozoal, brucellosis, hepatitis E), if ingesting local food and water, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (hepatitis A, typhoid/paratyphoid fever, brucellosis, hepatitis E). Risks from food/waterborne diseases may have been reduced with preventive medicine controls and mitigation, which includes hepatitis A and typhoid fever vaccinations and only drinking from approved water sources in accordance with standing CENTCOM policy. For other vector-borne endemic diseases (malaria, cutaneous leishmaniasis (acute), Crimean-Congo hemorrhagic fever, sandfly fever, scrub typhus (mite-borne), these diseases may constitute a significant risk due to exposure to biting vectors; risk reduced to 'Low' by proper wear of the treated uniform, application of repellent to exposed skin, bed net use, and appropriate chemoprophylaxis, as well as minimizing areas of standing water and other vector-breeding areas. For water contact diseases (leptospirosis) activities involving extensive contact with surface water increase risk. For respiratory diseases (TB), personnel in close-quarter conditions could have been at risk for person-to-person spread. Animal contact diseases (rabies, anthrax, Q fever), pose year-round risk. For heat stress, risk can be greater during months of May through September, 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 FOB Sharana. 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' for FOB Sharana. However, the entire Rushmore and vicinity area is an arid and dust-prone desert environment, also subject to vehicle traffic. Consequently, exposures to PM_{10} and $PM_{2.5}$ may vary, as conditions may vary, and may result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel while at this site, particularly exposures to high levels of dust such as during high winds or dust storms. For PM_{10} and $PM_{2.5}$, certain subgroups of the deployed forces (e.g., those with pre-existing asthma/cardio-pulmonary conditions) are at greatest risk of developing notable health effects. For Rushmore and vicinity, eight locations reported having burn pits – see Section 10.7. For burn pits, the PM_{10} and the $PM_{2.5}$ overall short-term risks were not evaluated at the eight reported burn pit locations at Rushmore and vicinity due to 'insufficient data' - see Section 10.7. For burn pits, 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 Rushmore 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 Rushmore and vicinity that includes Camp Boris, Camp Curry, FOB Khayr Kot Castle, FOB Kushamond, Firebase Shkin(Lilley), Camp Margah, Camp Mata Khan, Combat Outpost Munoz, FOB Orgun-E, FOB Rushmore, Camp Sar Howza, Camp Shadi, FOB Sharana, Super FOB Khayr Kot Castle, FOB Tillman, FOB Wazi Khwa, Camp Yahya Khel, Camp Yosef Kheyl, Combat Outpost Zerok:

For continuous noise exposure, the long-term risk was 'Low to Moderate'; risk may have been reduced by appropriate hearing protection used by personnel in higher risk areas (around sources of continuous noise such as flight line and power production).

Air quality: For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) from environmental dust, the overall long-term risk was 'Moderate' for FOB Sharana. Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}) from environmental dust was not evaluated for long-term risk due to no available health guidelines. However, the entire Rushmore and vicinity area is an arid and dust-prone desert environment, also subject to vehicle traffic, and conditions may have varied. In addition, for Rushmore and vicinity, eight locations reported having burn pits – see

Section 10.7. For burn pits, the PM10 and the PM2.5 overall long-term risks were not evaluated at the eight reported burn pit locations at Rushmore and vicinity due to 'insufficient data' and due to no available health guidelines for PM10 - see Section 10.7. However, burn pit exposures may vary, as conditions may have varied. For inhalational exposure to high levels of dust, PM10 and PM2.5, 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 while at Rushmore and vicinity 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 – Rushmore and vicinity that includes……[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 Moderate, Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/pre-existing respiratory diseases).	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: Low to Moderate, Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/pre-existing respiratory diseases).
	Long-term: No health guidelines		Long-term: No health guidelines
Particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$)	Short-term: Low, A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: Low, 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).
Metals	Short-term: no short term hazards based on the available data.		Short-term: no short term hazards based on the available data
	Long-term: no long term hazards based on the available data.		Long-term: no long term hazards based on the available data
Volatile Organic Compounds (VOC)	Short-term: Not enough data available		Short-term: Not enough data available
	Long-term: No enough data available		Long-term: Not enough data available
SOIL			
Metals	Short-term: Not an identified source of health risk.		Short-term: Not an identified source of health risk.
	Long-term: No data available		Long-term: No data available
Organic Compounds	Short-term: Not an identified source of health risk.		Short-term: Not an identified source of health risk.
	Long-term: No data available		Long-term: No data available
Inorganic Compounds	Short-term: Not an identified source of health risk.		Short-term: Not an identified source of health risk.
	Long-term: No data available		Long-term: No data available
Water			
Consumed Water (Water Used for Drinking)	Short-term: No data available	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: No data available.
	Long-term: No data available		Long-term: No data available.
Water for Other Purposes	Short-term: no short term hazards based on the available data.	Water treated in accordance with	Short-term: no short term hazards based on the available data

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
	Long-term: no long term hazards based on the available data.	standards applicable to its intended use	Long-term: no long term hazards based on the available data.
ENDEMIC DISEASE			
Food borne/Waterborne (e.g., diarrhea-bacteriological)	Short-term: Variable; High (bacterial diarrhea, hepatitis A, typhoid fever) to Moderate (diarrhea-cholera, diarrhea-protozoal, brucellosis, hepatitis E) to Low (polio) if ingesting local food/water, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (hepatitis A, Typhoid fever, hepatitis E, brucellosis).	Preventive measures include Hepatitis A and Typhoid fever vaccination and consumption of food and water only from approved sources.	Short-term: Low to none
	Long-term: none identified		Long-term: No data available
Arthropod Vector Borne	Short-term: 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 and Prevention (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 to potentially lethal effects	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 to potentially lethal effects.
	Long-term: No data available		Long-term: No data available
HEAT/COLD STRESS			

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
Heat	Short-term: Variable; Risk of heat injury is High for June-August, and Low from October – April and moderate from May - September.	Work-rest cycles, proper hydration and nutrition, and Wet Bulb Globe Temperature (WBGT) monitoring.	Short-term: low. However, the risk may be greater to certain susceptible persons–those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.
	Long-term: Low, 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 of the buddy system, limiting exposure during cold weather, proper hydration and nutrition, and proper wear of issued protective clothing.	Short-term: Low risk of cold stress/injury.
	Long-term: Low; Long-term health implications from cold injuries are rare but can occur, especially from more serious injuries such as frost bite.		Long-term: Low; Long-term health implications from cold injuries are rare but can occur, especially from more serious injuries such as frost bite.
NOISE			
Continuous (Flightline, Power Production)	Short-term: Low	Hearing protection used by personnel in higher risk areas	Short-term: Low
	Long-term: Low to moderate		Long-term: Low to moderate
Unique Incidents/ Concerns			
Burn Pits	Short-term: There were operating burn pits at Rushmore and vicinity (see Section 10.7). However, insufficient data were available to characterize short-term risk for PM_{10} and $PM_{2.5}$ at burn pits located at Rushmore and vicinity. Burn pit exposures may vary, and exposure to high levels of PM_{10} and $PM_{2.5}$ in the smoke may also result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups, such as those with pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases), while at this site.	Control measures may have included locating burn pits at increased distance from living and working areas when possible, and improved waste segregation and management techniques	Short-term: There were operating burn pits at Rushmore and vicinity (see Section 10.7). However, insufficient data were available to characterize short-term risk for PM_{10} and $PM_{2.5}$ at burn pits located at Rushmore and vicinity. Burn pit exposures may vary, and exposure to high levels of PM_{10} and $PM_{2.5}$ in the smoke may also result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups, such as those with pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases), while at this site.
	Long-term: There were operating burn pits at Rushmore and vicinity (see Section 10.7). However, insufficient data were available to characterize long-term risk for $PM_{2.5}$ and for PM_{10} at burn pits located at Rushmore and vicinity. In addition, there were no available health guidelines for evaluating long-term exposure to PM_{10}. Burn pit exposures may vary, and otherwise healthy personnel, who were exposed to smoke for a long period of time,		Long-term: There were operating burn pits at Rushmore and vicinity (see Section 10.7). However, insufficient data were available to characterize long-term risk for $PM_{2.5}$ and for PM_{10} at burn pits located at Rushmore and vicinity. In addition, there were no available health guidelines for evaluating long-term exposure to PM_{10}. Burn pit exposures may vary, and otherwise healthy personnel, who were exposed to smoke for a long period of time,

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
	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.		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 Rushmore and vicinity that includes, Camp Boris, Camp Curry, FOB Khayr Kot Castle, FOB Kushamond, Firebase Shkin(Lilley), Camp Margah, Camp Mata Khan, Combat Outpost Munoz, FOB Orgun-E, FOB Rushmore, Camp Sar Howza, Camp Shadi, FOB Sharana, Super FOB Khayr Kot Castle, FOB Tillman, FOB Wazi Khwa, Camp Yahya Khel, Camp Yosef Kheyl, Combat Outpost Zerok. It does not represent an individual exposure profile. Actual individual exposures and health effects depend on many variables. For example, while a chemical may have been present in the environment, if a person did not inhale, ingest, or contact a specific dose of the chemical for adequate duration and frequency, then there may have been no health risk. Alternatively, a person at a specific location may have experienced a unique exposure which could result in a significant individual exposure. Any such person seeking medical care should have their specific exposure documented in an SF600.

[2] This assessment is based on specific environmental sampling data and reports obtained from 1 January 2003 through 31 December 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 Rushmore 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 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 Rushmore and vicinity, Afghanistan by Source

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

2 Air

2.1 Site-Specific Sources Identified

Forward Operating Base (FOB) Rushmore and vicinity was situated in a dusty semi-arid mountainous 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.

FOB Sharana operated a five-bay burn pit facility located in the northeast part of the FOB near the Helicopter Landing Zone (HLZ). There was a DoD run HLZ, a contractor run HLZ, fire station and a few guard towers near the burn pit. There were burn barrels on FOB Sharana located between 15 and 20 feet from the living quarters, gym and the forward surgical team. Prevailing wind directions (from the East and Southeast) bring smoke and fumes over the FOB from the burn pits.

Dust storms, periods of high winds, and vehicle traffic passing through moon dust (very fine silts with the consistency of talcum powder) contribute to particulate matter (PM) exposures above health-based military exposure guidelines (MEGs) at FOB Sharana.

2.2 Particulate matter

Particulate matter (PM) is a complex mixture of extremely small particles suspended in the air. The PM includes solid particles and liquid droplets emitted directly into the air by sources such as: power plants, motor vehicles, aircraft, generators, construction activities, fires, and natural windblown dust. The PM can include sand, soil, metals, volatile organic compounds (VOC), allergens, and other compounds such as nitrates or sulfates that are formed by condensation or transformation of combustion exhaust. The PM composition and particle size vary considerably depending on the source. Generally, PM of health concern is divided into two fractions: PM_{10}, which includes coarse particles with a diameter of 10 micrometers or less, and fine particles less than 2.5 micrometers ($PM_{2.5}$), which can reach the deepest regions of the lungs when inhaled. Exposure to excessive PM is linked to a variety of potential health effects.

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

2.3.1 Exposure Guidelines:

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

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

- Negligible MEG = 250
- Marginal MEG = 420
- Critical MEG = 600
- Not defined and not available.

2.3.2 Sample data/Notes:

A total of 101 valid PM_{10} air samples were collected at the various locations of Rushmore and vicinity from 2006-2012. The PM_{10} samples were taken at Boris, Khayr Kot Castle, Rushmore, Sar Howza, Sharana, Shkin, Tillman, Wazi Khwa, Yahya Khel, and Zerok. There were no data available for the years 2003-2005, 2010 or 2014. There were 41 invalid PM_{10} air samples taken during 2009, 2011 and 2012. Of these 41 invalid samples, 24 were taken at Sharana, three taken at Boris, two from Curry, Rushmore, Tillman, Yahya Khel, Yousef Khel, and Zerok and then one invalid sample from Orgun E, and Wazi-Khwa. There were six samples associated with burn pits and these will be discussed in section 10.7. FOB Sharana was the only location that had enough available samples to do an assessment.

Sharana: A total of 85 valid PM_{10} samples were collected at FOB Sharana from 9 February 2007 to 27 October 2012. The range of 24-hour PM_{10} concentrations was 36 $\mu g/m^3$ – 882 $\mu g/m^3$ with an average concentration of 183 $\mu g/m^3$.

Boris: One valid PM_{10} sample, (97 $\mu g/m^3$) was collected at Camp Boris on 18 August 2009.

Khayr Kot Castle: One valid PM_{10} sample (208 $\mu g/m^3$) was collected at FOB Khayr Kot Castle on 18 October 2009.

Kushamond: One valid PM_{10} sample (876 $\mu g/m^3$) was collected at Camp Kushamond on 26 October 2007.

Rushmore: A total of two valid PM_{10} samples with concentrations of 122 $\mu g/m^3$ and 255 $\mu g/m^3$ were collected at FOB Rushmore during 19 April 2009 to 3 April 2013.

Sar Howza: One valid PM_{10} sample (58 $\mu g/m^3$) was collected at Camp Sar Howza on 5 April 2013.

Shkin: A total of two valid PM_{10} samples (111 $\mu g/m^3$ and 120 $\mu g/m^3$) were collected at Camp Shkin from 14 September 2009 to 15 September 2009.

Tillman: A total of five valid PM_{10} samples were collected at Camp Tillman from 4 September 2009 to 18 April 2011. The concentrations ranged from 18 $\mu g/m^3$ to 57 $\mu g/m^3$ with an average concentration of 34 $\mu g/m^3$.

Wazi-Khwa: A total of three valid PM_{10} samples were collected at Camp Wazi-Khwa from 11 June 2006 to 12 June 2006. The concentrations ranged from 138 $\mu g/m^3$ to 169 $\mu g/m^3$ with an average concentration of 154 $\mu g/m^3$.

2.3.3 Short-term health risks:

FOB Sharana: Low to Moderate: The short-term PM_{10} health risk assessment is Low to moderate based on average and peak PM_{10} sample concentrations, and the likelihood of exposure at these hazard severity levels. A High health risk assessment is expected to significantly degrade mission capabilities by lowering the execution standard, preventing completion of essential tasks, and jeopardizing mission completion if hazards arise during the mission. Some in-theater medical

countermeasures and resources anticipated. (Reference 4, Table 3-2). Daily average health risk levels for PM_{10} show no hazard for 78%, low health risk for 19%, moderate health risk for 3%, and high health risk for 0% of the time. Confidence in the short-term PM_{10} health risk assessment is low (Reference 4, Table 3-6).

The hazard severity for average PM_{10} concentrations in samples was negligible. The results predict a few personnel may experience notable mild eye, nose, or throat irritation; most personnel will experience only mild effects. Service members with pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may have experienced an exacerbation of their conditions (Reference 4, Table 3-11).

For the highest observed PM_{10} sample concentration, the hazard severity ranged from negligible to critical. During peak exposures at the critical hazard severity level (above 600 $\mu g/m^3$), the results predict that most, if not all, personnel would have experienced very notable eye, nose, and throat irritation and respiratory effects. Visual acuity is impaired, as is overall aerobic capacity. Some personnel will not have been able to perform their assigned duties. Some lost-duty days expected. Those with a history of asthma or cardiopulmonary disease will have experienced more severe symptoms. (Reference 4, Table 3-11).

2.3.4 Long-term health risk:

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

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

2.4.1 Exposure Guidelines:

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

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

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

- Negligible MEG = 15
- Marginal MEG = 65.

2.4.2 Sample data/Notes:

No samples were available at any of the locations for the years 2003-2007. There were three samples associated with burn pits and these will be discussed in section 10.7. There were 13 invalid samples, taken in 2008, 2009, and 2012 that could not be used in this evaluation. Ten of these invalid samples were taken at FOB Sharana, two taken at Sar Howza, and one taken at Super FOB KKC. FOB Sharana is the only location that had enough available samples to do an assessment.

Sharana: A total of 33 valid $PM_{2.5}$ samples were collected at FOB Sharana from 12 August 2008 to 8 October 2010. The range of 24-hour $PM_{2.5}$ concentrations was 6 $\mu g/m^3$ – 303 $\mu g/m^3$ with an average concentration of 92 $\mu g/m^3$. There were two $PM_{2.5}$ samples associated with the burn pit which were not included in this ambient air assessment and will be discussed in the Burn pit section.

Rushmore: A total of three valid $PM_{2.5}$ airborne samples were collected at FOB Rushmore from 21 April 2009 to 3 April 2013. The range of 24-hour $PM_{2.5}$ concentrations was 14 $\mu g/m^3$ – 34 $\mu g/m^3$ with an average concentration of 22 $\mu g/m^3$. There was not enough data to evaluate a risk at this location.

Sar Howza: One valid $PM_{2.5}$ airborne sample (10 µg/m^3) was collected at Camp Sar Howza on 5 April 2013. There was not enough data to evaluate a risk at this location.

Super FOB KKC: One valid $PM_{2.5}$ sample (35 µg/m^3) was collected at Super FOB Khayr Kot Castle on 18 April 2013. There was not enough data to evaluate a risk at this location.

2.4.3 Short-term health risks:

FOB Sharana: Low: The short-term $PM_{2.5}$ health risk assessment is Low based on average and peak $PM_{2.5}$ sample concentrations, and the likelihood of exposure at these hazard severity levels. A Low health risk assessment is expected to result in losses that will have little or no impact on accomplishing the mission (Reference 4, Table 3-2). Daily average health risk levels for $PM_{2.5}$ show no hazard for 40%, low health risk for 60%, moderate health risk for 0%, and high health risk for 0% of the time. Confidence in the short-term $PM_{2.5}$ health risk assessment was low (Reference 4, Table 3-6).

The hazard severity was negligible for average $PM_{2.5}$ sample concentrations. The results indicate that a few personnel may experience notable mild eye, nose, or throat irritation; most personnel will experience only mild effects. Service Members with pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may have experienced an exacerbation of their conditions. (Reference 4, Table 3-11).

For the highest observed $PM_{2.5}$ exposure, the hazard severity was marginal. During peak exposures at the marginal hazard severity level, a majority of personnel may experience notable mild eye, nose, or throat irritation; most personnel will experience only mild effects. Service Members with pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may have experienced an exacerbation of their conditions (Reference 4, Table 3-11).

2.4.4 Long-term health risks:

FOB Sharana: Moderate: The long-term health risk assessment is moderate based on average $PM_{2.5}$ concentration, and the likelihood of exposure at this hazard severity level. A moderate health risk level suggests that with repeated exposures above this, a small percentage of personnel may have increased risk for developing chronic conditions, such as reduced lung function or exacerbated chronic bronchitis, COPD, asthma, atherosclerosis, or other cardiopulmonary diseases. Personnel with a history of asthma or cardiopulmonary disease are considered to be at particular risk. (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 for average $PM_{2.5}$ sample concentrations. The results suggest that with repeated exposures above the marginal hazard severity threshold, it is plausible that development chronic conditions, such as reduced lung function or exacerbated chronic bronchitis, COPD, asthma, atherosclerosis, or other cardiopulmonary diseases could occur in generally healthy troops. Personnel with history of asthma or cardiopulmonary disease are considered to be at particular risk of developing chronic conditions. (Reference 4, Table 3-12).

2.5 Airborne Metals

2.5.1 Sample data/Notes:

PM_{10} airborne metal samples:

No PM_{10} airborne metal samples were available for base camp Curry, Margah, Mata Kahn, Orgun E or Yousef Khel. For all of the remaining locations, no PM_{10} metal samples were above their short or long term MEGS.

Boris: One valid PM_{10} airborne metal sample was collected at Camp Boris on 18 August 2009; no metals were detected above the 1 year negligible MEGs.

Khayr Kot Castle: One valid PM_{10} airborne metal sample was collected at FOB Khayr Kot Castle on 18 October 2009; no metals were detected above the 1 year negligible MEGs.

Kushamond: One valid PM_{10} airborne metal sample was collected at Camp Kushamond on 26 October 2007; no metals were detected above the 1 year negligible MEGs.

Rushmore: A total of two valid PM_{10} airborne metal samples were collected at FOB Rushmore from 19 April 2009 to 3 April 2013, no metals were detected above the 1 year negligible MEGs.

Sar Howza: One valid PM_{10} airborne metal sample was collected at Camp Sar Howza on 5 April 2013; no metals were detected above the 1 year negligible MEGs.

Sharana: A total of 85 valid PM_{10} airborne metal samples were collected at FOB Sharana from 9 February 2007 to 27 October 2012, no metals were detected above the 1 year negligible MEGs.

Shkin: A total of two valid PM_{10} airborne metal samples were collected at Camp Shkin from 14 September 2009 to 15 September 2009, no metals were detected above the 1 year negligible MEGs.

Tillman: A total of five valid PM_{10} airborne metal samples were collected at Camp Tillman from 4 September 2009 to 18 April 2011, no metals were detected above the 1 year negligible MEGs.

Wazi-Khwa: A total of three valid PM_{10} airborne metal samples were collected at Camp Wazi-Khwa from 11 June 2006 to 12 June 2006, no metals were detected above the 1 year negligible MEGs.

Yahya Khel: One valid PM_{10} airborne metal sample was collected at Camp Yahya Khel on 28 April 2011; no metals were detected above the 1 year negligible MEGs.

$PM_{2.5}$ airborne metal samples:

FOB Sharana, FOB Rushmore, Camp Sar Howza, and Super FOB Khayr Kot Castle were the only locations that have valid $PM_{2.5}$ airborne metal samples available for this assessment. See the results of each location below:

Sharana: A total of 33 valid $PM_{2.5}$ airborne metal samples were collected at FOB Sharana from 12 August 2008 to 8 October 2010. No $PM_{2.5}$ airborne metals were above their short or long term MEGS.

Rushmore: A total of three valid $PM_{2.5}$ airborne metal samples were collected at FOB Rushmore from 21 April 2009 to 3 April 2013. No $PM_{2.5}$ airborne metals were above their corresponding 1 year negligible MEGS.

Sar Howza: One valid $PM_{2.5}$ airborne metal sample was collected at Camp Sar Howza on 5 April 2013. This sample did not have any airborne metals above their corresponding 1 year negligible MEGs.

Super FOB Khayr Kot Castle: One valid $PM_{2.5}$ airborne metal sample was collected at Super FOB Khayr Kot Castle on 18 April 2013. This sample did not have any airborne metals above their corresponding 1 year negligible MEGs.

2.5.2 Short-term health risks:

None identified based on the available sampling data.

2.5.3 Long-term health risks:

None identified based on the available sampling data.

2.6 Volatile Organic Compounds (VOC)

2.6.1 Sample data/Notes:

There were not enough samples to conduct a health risk assessment. There were only six valid volatile organic compound air samples collected at FOB Sharana and two valid samples taken at Super FOB Khayr Kot Castle. There were three invalid volatile organic compound samples taken at FOB Sharana and were invalid due to sampling error. There were no volatile organic compound air samples taken at Camp Boris, Curry, Kushamond, Margah, Mata Kahn, Orgun E, Rushmore, Sar Howza, Shkin, Tillman, Wazi-Khwa, Yahya Khel or Yousef Khel.

FOB Sharana: All six samples were taken from 28 November 2009 through 12 December 2009. There were 13 chemicals detected in the samples, and all were below their corresponding 1 year negligible MEGs.

Super FOB Khayr Kot Castle: The two valid samples at this location were both taken on 20 April 2013. There were no detected volatile organic chemicals in air from either of these samples.

2.6.2 Short and long-term health risks:

Not enough data to determine a risk.

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 these locations for 6 months to 1 year.

Boris: A total of 12 valid surface soil samples were collected from 23 September 2006 to 24 May 2011, to assess OEH health risk to deployed personnel. All concentrations were below the 1 year negligible MEGs at this location.

Curry: A total of four valid surface soil samples were collected from 15 June 2008 to 3 July 2012, to assess OEH health risk to deployed personnel. All samples were below the 1 year negligible MEGs at this location.

Khayr Kot Castle: A total of three valid surface soil samples were collected on 2 March 2007, to assess OEH health risk to deployed personnel. All samples were below the 1 year negligible MEGs at this location.

Kushamond: A total of 14 valid surface soil samples were collected from 7 June 2007 to 21 April 2009, to assess OEH health risk to deployed personnel. All samples were below the 1 year negligible MEGs at this location.

Margah: A total of five valid surface soil samples were collected from 1 June 2008 to 19 June 2012, to assess OEH health risk to deployed personnel. All samples were below the 1 year negligible MEGs at this location.

Mata Kahn: A total of three valid surface soil samples were collected on 19 June 2011, to assess OEH health risk to deployed personnel. All samples were below the 1 year negligible MEGs at this location.

Orgun E: A total of five valid surface soil samples were collected from 2 April 2007 to 5July 2012, to assess OEH health risk to deployed personnel. All samples were below the 1 year negligible MEGs at this location.

Rushmore: A total of 11 valid surface soil samples were collected from 24 August 2008 to 3 April 2013, to assess OEH health risk to deployed personnel. All samples were below the 1 year negligible MEGs at this location.

Sar Howza: A total of five valid surface soil samples were collected from 27 May 2011 to 5 April 2013, to assess OEH health risk to deployed personnel. All samples were below the 1 year negligible MEGs at this location.

Sharana: A total of 29 valid surface soil samples were collected from 26 April 2007 to 28 May 2013, to assess OEH health risk to deployed personnel. All samples were below the 1 year negligible MEGs at this location.

Shkin: A total of five valid surface soil samples were collected from 7 June 2007 to 3 July 2011, to assess OEH health risk to deployed personnel. All samples were below the 1 year negligible MEGs at this location.

Super FOB Khayr Kot Castle: A total of two valid surface soil samples were collected from 20 March 2012 to 20 April 2013, to assess OEH health risk to deployed personnel. All samples were below the 1 year negligible MEGs at this location.

Tillman: A total of 14 valid surface soil samples were collected from 4 April 2007 to 30 June 2012, to assess OEH health risk to deployed personnel. All samples were below the 1 year negligible MEGs at this location.

Wazi-Khwa: A total of 13 valid surface soil samples were collected from 5 September 2006 to 5 April 2011, to assess OEH health risk to deployed personnel. All samples were below the 1 year negligible MEGs at this location.

Yahya Khel: A total of three valid surface soil samples were collected on 28 April 2011, to assess OEH health risk to deployed personnel. All samples were below the 1 year negligible MEGs at this location.

Yousef Khel: A total of three valid surface soil samples were collected on 9 July 2012, to assess OEH health risk to deployed personnel. All samples were below the 1 year negligible MEGs at this location.

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 FOB Rushmore and vicinity will be directly exposed to reverse osmosis water purification unit (ROWPU) treated, disinfected fresh bulk water, bottled water, and untreated well water since this classification of water is primarily used for personal hygiene, showering, cooking, and for use at vehicle wash racks. Field data sheets indicate that bottled water was the approved source of drinking water.

4.1 Drinking Water: Bottled or Packaged Water

4.1.1 Site-Specific Sources Identified

No bottled water samples were available for this evaluation. The brands of bottled water reported as used at Camp Curry, Boris and Super FOB Khayr Kot Castle included Aria®, Cristal® and Kinley®. FOB Sharana reported Kinley® and Nestle® bottled water brands. FOB Rushmore and Camp Margah reported using Aria brand bottled water. Identification of a trademarked product does not imply endorsement by the Army. No information was available on the types of brands used at FOB Kushamond, Camp Mata Kahn, FOB Orgun E, Camp Sar Howza,COP Munoz, FOB Khayr Kot Castle, 5th ABP Compound, Firebase Shkin, FOB Tillman, FOB Wazi-Khwa, Camp Yahya Khel or Camp Zerok.

4.1.2 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. No bottled water samples were available for evaluation. There was one ROWPU treated water sample, taken at FOB Sharana that was listed as being used for drinking water, it was taken in 2011. Due to the limited amount of samples no determination of risk can be done; however all of the detected contaminants in these two samples were below their respective 1 year negligible 5 liters per day (L/day) and/or negligible 14day 15L/day MEGs.

4.1.3 Short-term and long-term health risk:

No sample data available for evaluation.

4.2 Non-Drinking Water: Disinfected

4.2.1 Site-Specific Sources Identified

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

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 5L/day of non-drinking water for up to 365 days (1-year). The only location that had enough samples to do an assessment of long and short term risk was FOB Sharana. Even though there weren't enough samples to determine a health risk, of the samples available at the other locations, no chemicals were detected at levels above the short or long-term MEGs.

4.2.2 Sample data/Notes:

FOB Sharana:

A total of 23 non-drinking water samples used for showering, laundry and personal hygiene from 2006-2013 were available for this health risk assessment. No chemicals were detected at levels above the short or long-term MEGs.

Boris: There were seven non-drinking water samples taken from 2007-2012.

Curry: There were three non-drinking water samples taken in 2008, 2010 and 2012.

Khayr Kot Castle: There were three non-drinking water samples taken in 2007, 2010 and 2011.

Kushamond: There were four non-drinking water samples taken during 2007-2009.

Margah: There was one nondrinking water sample taken in 2011.

Mata Khan: There was one nondrinking water sample taken in 2011.

Munoz: There was one nondrinking water sample taken in 2011.

Orgun-E: There were 10 non-drinking water samples taken during 2006-2009 and 2011-2013.

Rushmore: There were eight non-drinking water samples taken from 2007-2014.

Sar Howza: There were two non-drinking water samples taken in 2011 and 2013.

Shkin: There were three non-drinking water samples taken in 2007 and 2011.

Super FOB Khayr Kot Castle: There were four non-drinking water samples taken during 2011-2013.

Tillman: There were eight non-drinking water samples taken from 2007-2008 and 2011-2012.

Wazi-Khwa: There were eight non-drinking water samples taken from 2006-2010.

Yahya Khel: There was one non-drinking water sample taken in 2011.

Yousef Khel: There were two non-drinking water samples taken in 2011 and 2012.

Zerok: There were two non-drinking water samples taken in 2011 and 2012.

4.2.3 Short and long-term health risks:

None identified based on the available sampling 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 1 January 2003 to 31 December 2014 timeframe (References 1 and 5).

5.2 Depleted Uranium (DU)

No specific hazard sources were documented in the DOEHRS or MESL from 1 January 2003 to 31 December 2014 timeframe (References 1 and 5).

5.3 Ionizing Radiation

No specific hazard sources were documented in the DOEHRS or MESL from 1 January 2003 to 31 December 2014 timeframe (References 1 and 5).

5.4 Non-Ionizing Radiation

There were several different sources of non-ionizing radiation at FOB Sharana. There were multiple communication antennas and satellite dishes located throughout the camp, as well as duke systems in the convey vehicles sources were documented in the DOEHRS or MESL from 1 January 2003 to 31 December 2014 timeframe (References 1 and 5). The documentation does not mention any types of controls being used, nor have there been any non-ionizing radiation related injuries. Information was not available for any of the other locations in this document.

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 *Leptospira* present in the soil passes directly into surface waters. *Leptospira* can enter the body through cut or abraded skin, mucous membranes, and conjunctivae. Infection may also occur from ingestion of contaminated water. The acute, generalized illness associated with infection may mimic other tropical diseases (for example, dengue fever, malaria, and typhus), and common symptoms include fever, chills, myalgia, nausea, diarrhea, cough, and conjunctival suffusion. Manifestations of severe disease can include jaundice, renal failure, hemorrhage, pneumonitis, and hemodynamic collapse. Recreational activities involving extensive water contact may result in personnel being temporarily debilitated with leptospirosis. Incidence could result in debilitating febrile illness typically requiring 1 to 7 days of inpatient care, followed by return to duty; some cases may require prolonged convalescence. This disease is associated with a Moderate health risk estimate.

6.3.2 Short-term health risks:

Low: Unmitigated Health risk of leptospirosis is Moderate during warmer months. Mitigation measures reduce the risk to Low. Confidence in the health risk estimate is high.

6.3.3 Long-term health risks:

None identified based on available data.

6.4 Respiratory Diseases

Although not specifically assessed in this document, deployed U.S. forces may be exposed to a wide variety of common respiratory infections in the local population. These include influenza, pertussis, viral upper respiratory infections, viral and bacterial pneumonia, and others. The U.S. military populations living in close-quarter conditions are at risk for substantial person-to-person spread of respiratory pathogens. Influenza is of particular concern because of its ability to debilitate large numbers of unvaccinated personnel for several days. Mitigation strategies were in place and included routine medical screenings, vaccination, enforcing minimum space allocation in housing units, implementing head-to-toe sleeping in crowded housing units, implementation of proper personal protective equipment (PPE) when necessary for healthcare providers and detention facility personnel.

6.4.1 Tuberculosis (TB)

Moderate, mitigated to Low: Potential health risk to U.S. personnel is Moderate, mitigated to Low, year round. Transmission typically requires close and prolonged contact with an active case of pulmonary or laryngeal TB, although it also can occur with more incidental contact. 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 the Clinical Toxinology Resources web site from the University of Adelaide, Australia (Reference 9). The species listed below have home ranges that overlap the location of FOB Rushmore and vicinity, and may present a health risk if they are encountered by personnel. See Section 9 for more information about pesticides and pest control measures.

7.1 Spiders

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

7.2 Scorpions

- *Buthacus striffleri*, *Compsobuthus afghanus*, *Mesobuthus caucasicus, Mesobuthus eupeus, Mesobuthus macmahoni, Orthochirus afghanus, 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.

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

7.3 Snakes

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

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

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

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

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

7.4 Short-term health risk:

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

7.5 Long-term health risk:

None identified.

8 Heat/Cold Stress

8.1 Heat

These camps located in the Paktika province have a cold desert climate with precipitation concentrated in the winter and spring months. Summers are long and hot but have a low humidity. The Warm season last from around the middle of May to the end of September with average daily temperatures above 76 degrees Fahrenheit (°F). The average weather throughout the year ranges from around 17 °F to 87°F and rarely going below 6°F or above 92°F.

The health risk of heat stress/injury based on temperatures alone is Low (< 78 °F) from October – April, Moderate (78-81.9°F) in May and September, high (82-87.9°F) and extremely high (≥ 88°F) from June – August. However, work intensity and clothing/equipment worn pose greater health risk of heat stress/injury than environmental factors alone (Reference 9). Managing risk of hot weather operations included monitoring work/rest periods, proper hydration, and taking individual risk factors (e.g., acclimation, weight, and physical conditioning) into consideration. 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). However, the risk may be greater 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). Confidence in the health risk estimate is medium (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:

The cold season lasts from the end of December to the end of February with an average daily high temperature below 43°F. Because even on warm days a significant drop in temperature after sunset by as much as 40 °F can occur, there is a risk of cold stress/injury from December – March. The risk assessment for Non-Freezing Cold Injuries (NFCI), such as chilblain, trench foot, and hypothermia, is Low based on historical temperature and precipitation data. Frostbite is unlikely to occur because temperatures rarely drop below freezing. However, personnel may encounter significantly lower temperatures during field operations at higher altitudes. As with heat stress/injuries, cold stress/injuries are largely dependent on operational and individual factors instead of environmental factors alone (Reference 9).

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

8.2.2 Long-term health risk:

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

9 Noise

9.1 Continuous

Aircraft operations have the potential to cause significant noise hazard to flight line and helicopter landing zone support personnel. Because of the potential noise hazard inherent in flight line operations and the helicopter landing zone, personnel are required to wear dual hearing protection when working on the flight line.

Personnel residing in close proximity to generators will routinely be exposed to noise levels as high as 82.0 decibels (dB). Although this is below the 85 dB threshold requiring hearing protection, it still presents a concern for hearing conservation.

9.1.1 Short health risks:

Low: The short-term risk of noise injury with appropriate hearing protection use is low. Few exposed personnel (if any) are expected to have noticeable health effects during mission. Confidence in risk assessment is low (Reference 4).

9.1.2 Long-term health risk:

Low to moderate: The long-term risk of noise injury with appropriate hearing protection use is low with few exposed personnel (if any) are expected to develop delayed onset, irreversible effects. If protective measures are not used, the risk is elevated to moderate and many exposed personnel are plausibly expected to develop delayed onset, irreversible effects. Confidence in risk assessment is low (Reference 4).

9.2 Impulse

No specific hazard sources were documented in the DOEHRS or MESL from 01 January 2003 to 31 December 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

Hazardous Waste:

FOB Sharana: There is a Defense Reutilization and Marketing Office (DRMO) hazardous material (Hazmat) yard with over 100, 50-gallon drums. Hazardous materials are shipped to Bagram or Shank on a bi-weekly basis.

The 2009 environmental conditions report identified incompatibly stored hazardous and non-hazardous wastes in a Connex on FOB Sharana in December 2008. The potential for similar situations elsewhere on the FOB was high (other collections of drums were identified on the FOB). The Connex containing the incompatible HazMat had no secondary containment, but the spent oil filters were in UN-approved steel drums. The materials were safely removed from the Connex. Non-hazardous materials (41 empty cylinders) were placed back into the Connex. Hazardous materials (wet cell batteries,

communication equipment batteries, spent fuel, and oil filters) and the 161 drums of various non-hazardous material scattered throughout the FOB were transported to KBR's HazMat facility at Bagram Air Field (BAF), Afghanistan.

FOB Kushamond: In 2011, 208 liters (L) of motor oil and 208L of other related POL were stored at FOB Kushamond. Hazardous Material is shipped to FOB Sharana for proper disposal.

FOB Orgun-E: All hazardous waste is shipped to FOB Sharana for disposal according to the OEHSA 2012.

Camp Curry: The 2012 OEHSA reported that unknown amounts of lead acid batteries and 200 containers of POL products were stored at Camp Curry.

Information on hazardous waste was not available for all other locations included in this report.

Solid waste:

FOB Sharana: According to the 2009 environmental conditions report and OEH Site Assessment (OEHSA) reports from 2012-2013, solid waste from the LSA, DFAC, Operations and other areas on the base were disposed of in contractor operated burn pits. Two regulated medical waste (RMW) incinerators were assembled in June 2010 and at least one is operational as of 2011. Pre-RMW incinerators, RMW was red-bagged and stockpiled in a designated Connex awaiting incineration. No further information was provided as to where the RMW was incinerated before 2010.

FOB Kushamond: According to the 2011 OESHA report, all trash/garbage from around the FOB was collected and disposed of in burn pits. Any medical waste was shipped to FOB Sharana for disposal.

FOB Orgun-E: According to the 2012 OESHA report, trash was collected and disposed of in the burn pits while medical waste was disposed of in one of two medical incinerators located on the base.

Camp Curry: Trash is disposed of in burn pits and medical waste is collected and transported to FOB Orgun-E for disposal according to the 2012 OESHA report.

FOB Rushmore: The 2014 OEHSA report documented that trash was hauled off several times a day by contractors and a few burn boxes were used to dispose of documents.

Super FOB KKC: The 2013 OESHA report indicated that trash was burned in burn pits at Super FOB KKC.

Information on solid waste was not available for any of the other locations included in this assessment.

Wastewater:

FOB Sharana: There was a wastewater facility on the base that treats both black water and gray water at about 80,000-100,000 gallons a day. The wastewater was collected in tank trailers, holding tanks, ponds, pipes and pump stations. The black water was piped to a stream that leads to a holding pond on the FOB for disposal via evaporation.

FOB Rushmore and FOB Kushamond: The wastewater was trucked off site for disposal.

Camp Curry: Some of the wastewater is stored in tanks and some is piped off site for disposal.

There was no wastewater information available for the other locations included in this document.

General Sanitation:

FOB Sharana: Several reports and databases were assessed for waste collection/storage; latrine, shower and laundry facilities; hand washing stations; sanitary practices in barber/beauty shops and gymnasiums; living accommodations and report vector/pest problems. A total of nine base camp assessments from August 2002 through July 2005 characterized overall sanitation conditions at three distinct communities occupying FOB Sharana.

Sanitation concerns that can affect or potentially affect personnel stationed at FOB Sharana included documentation of raw sewage/liquid waste leaking from latrines; consumption of non-potable water from wells, local municipalities, or surface reservoirs (streams, rivers, lakes); unsatisfactory waste management operations and free standing water; sanitation team or the FOB engineering support element not implementing local pest control activities; feral dogs and cats migrating onto FOB and/or are allowed to breed on the FOB and poor sanitation at the barber/beauty shop (does not wash and sanitize scissors), and gym (gym equipment not disinfected and sanitized).

Super FOB KKC: There were some sanitation concerns noted in the 2013 OEHSA about the accumulation of trash directly outside the DFAC kitchen backdoor, no use of trashcans. Trash would accumulate for two-three hours before being transferred to the burn pit. There were also reports of trash cans overflowing outside the housing/office areas as well.

FOB Kushamond: It was noted in the 2011 OEHSA that the DFAC received an unsatisfactory rating but no other sanitation issues were noted.

10.3 Fuel/petroleum products/industrial chemical spills

FOB Sharana: The 2013 OEHSA reported the main fuel point having three 20,000 gallon bladders, and one 10,000 gallon bladder of JP-8 (jet fuel) and also one 20,000 gallon bladder of gasoline at the site.

An environmental conditions report completed in February 2009 by the U.S. Army Corps of Engineers and the US Air Force identified several fuel spills at FOB Sharana. The largest fuel spill occurred at the Fuel Point on 31 January 2009. About 1,200 gallons of JP-8 was released from an over-filled fuel bladder. Remediation consisted of applying clean soil to soak up the fuel and excavation of contaminated soil and gravel to the former wastewater lagoon area where it was treated. Contaminated soil in excess of 2-ft deep was left in place under the bag farm's secondary containment walls to avoid structural compromise.

The second largest spill occurred on 28 January 2009, when a contracted AN-28 cargo plane crashed near the runway. At least 600 gallons of fuel leaked from the center and starboard wing tanks during and after impact. Clay soil was scraped and bulldozed down to a small dry gulley, and pushed downstream. Remediation consisted of excavation of contaminated soil to the former sewage lagoon where it was treated

Two spills at the Fuel Point's Jingle Truck fuel transfer area were excavated to a depth of 3 ft. The contaminated soil was removed and taken to the burn pit for thermal treatment. No additional information was available on this spill.

A 1,000 gallon fuel spill occurred on FOB Sharana in 2011 and also it was noted that a fuel spill occurred in August 2012 at FOB Sharana but no further information was available for either of these spills.

FOB Kushamond: In 2011, there was a bulk fuel farm that had five 5,000 gallon bladders of JP-8 fuel and there was also a forward air refueling point (FARP) with two, 5,000 gallon bladders of JP-8 fuel. A small spill as a result of fueling operations was reported in December 2011, no further information was available.

FOB Orgun-E: Based on the 2012 OESHA there were three, 190,000L bladders containing JP-8 and the vehicle fuel point had two 50,000 gallon blivets storing diesel fuel. It was also reported that there was a 560,000 gallon bladder of JP-8 and a 1,900L tank of JP-8 at unknown locations. No spills were reported at this location.

Camp Curry: The 2012 OESHA noted there was a fuel distribution site called Fuel 1 that housed a 38,000L tank of JP-8 and then the motor pool had a 76,000L blivet of JP-8. No spills were reported but it was noted that there was some staining around the fuel distribution site.

Super FOB KKC: It was noted in the 2013 OEHSA that JP-8 and diesel fuel are stored in blivets at the FOB but the amounts and locations were unknown.

Short-term and Long-term risks: Low. The large spills on FOB Sharana at the fuel point and airfield were remediated, but some contaminated soils remain. Confidence in this risk estimate is medium.

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. Numerous monthly pesticide application reports in the MESL data portal for Rushmore and vicinity list (Curry, Kushamond, Rushmore, Shkin, Khayr Kot Castle, Orgun-E, Sharana, Tillman, and Zerok specifically) 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

These rodenticides listed below were found at the following locations: Curry, Kushamond, Rushmore, Shkin, Khayr Kot Castle, Orgun-E, Sharana, Tillman, and Zerok

Bromadiolone, Brodifacoum, Diphacinone, and 2-(Diphenylacetyl)-1, 3-indandione, sodium salt were used to control rodents.

10.4.2 Insecticides

Insecticides used to control ants, bees, bedbugs, crickets, centipedes, cockroaches, fleas, flies, lice, mosquitoes, spiders, termites, ticks and wasps include the following listed below separated by location.

Curry: *Imidacloprid, Lambda-cyhalothrin, Methomyl, Nithiazine,* and *Z-9 Tricosene.*

Khayr Kot Castle: *Fipronil, Imidacloprid, Methomyl,* and *Z-9 Tricosene.*

Kushamond: *Bacillus thuringiensis subspecies israelensis, delamethrin, d-trans Allethrin, Imidacloprid, Lambda-cyhalothrin, Methomyl,* and *Z-9 Tricosene.*

Orgun-E: *Bacillus thuringiensis subspecies israelensis, Brodifacoum, β-Cyfluthrin, d-trans Allethrin, delamethrin, Fipronil, Hydramethylnon, Imidacloprid, Lambda-cyhalothrin, Methomyl, Nithiazine, Pyrethrins, Piperonyl Butoxide, permethrin, Phenothrin, (S)-Methoprene,* and *Z-9 Tricosene.*

Rushmore: *β-Cyfluthrin, Fipronil, Imidacloprid, Methomyl, Nithiazine, (S)-Methoprene,* and *Z-9 Tricosene.*

Sharana: *Bacillus thuringiensis subspecies israelensis, Boric Acid, β-Cyfluthrin, Cypermethrin, d-trans Allethrin, delamethrin, DEET, Diethyl toluamide, Fipronil, Hydramethylnon, (7S)-Hydroprene, Imidacloprid, Lambda-cyhalothrin, Methomyl, Nithiazine, Pyrethrins, Piperonyl Butoxide, permethrin, Phenothrin, (S)-Methoprene,* and *Z-9 Tricosene.*

Shkin: *Bacillus thuringiensis subspecies israelensis, β-Cyfluthrin, d-trans Allethrin, delamethrin, Imidacloprid, Lambda-cyhalothrin, Methomyl, Nithiazine, Pyrethrins, Piperonyl Butoxide, (S)-Methoprene,* and *Z-9 Tricosene.*

Tillman: *Bacillus thuringiensis subspecies israelensis, Boric Acid, βd-trans Allethrin, delamethrin, DEET, Imidacloprid, Lambda-cyhalothrin, Methomyl, Nithiazine, Pyrethrins, permethrin, (S)-Methoprene,* and *Z-9 Tricosene.*

Zerok: *Bacillus thuringiensis subspecies israelensis, delamethrin, DEET, Imidacloprid, Lambda-cyhalothrin, Methomyl, Nithiazine, (S)-Methoprene,* and *Z-9 Tricosene.*

10.4.3 Short-term and Long-term health risks

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

10.5 Asbestos

There was no data available to evaluate.

10.6 Lead Based Paint

There was no data available to evaluate.

10.7 Burn Pit

While not specific to Rushmore and vicinity, the consolidated epidemiological and environmental sampling and studies on burn pits that have been conducted as of the date of this publication have been unable to determine whether an association does or does not exist between exposures to emissions from the burn pits and long-term health effects (Reference 10). The Institute of Medicine

committee's (Reference 10) review of the literature and the data suggests that service in Iraq or Afghanistan (i.e., a broader consideration of air pollution than exposure only to burn pit emissions) may be associated with long-term health effects, particularly in susceptible (e.g., those who have asthma) or highly exposed subpopulations, such as those who worked at the burn pit. Such health effects would be due mainly to high ambient concentrations of PM from both natural and anthropogenic sources, including military sources. If that broader exposure to air pollution turns out to be relevant, potentially related health effects of concern are respiratory and cardiovascular effects and cancer. Susceptibility to the PM health effects could be exacerbated by other exposures, such as stress, smoking, local climatic conditions, and co-exposures to other chemicals that affect the same biologic or chemical processes. Individually, the chemicals measured at burn pit sites in the study were generally below concentrations of health concern for general populations in the 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.

Eight locations included in this assessment reported having burn pits and each site is described below.

Camp Boris: A 40 cubic meter burn pit that was operated by local nationals reported disposing of 1,225 kilograms (kg) of trash a day, the location of the burn pit was not noted but the available information stated that part of the exiting controls that were used were PPE and that the burn pit burned down wind of the camp. There were no samples available for this location.

Camp Curry: It was reported that a 3m x 8m burn pit was used to burn residential solid waste and was run by local nationals; no other information or samples were available.

FOB Kushamond: The available information noted that an 8m x 15m wide and 2m deep burn pit was located outside the FOB and run by local nationals. It was noted that the existing controls used were PPE and burning downwind of the FOB. No other information or samples were available.

Camp Margah: The available information was that a burn pit was located outside the first perimeter and was operated by troop labor. No other information or samples were available.

Camp Orgun-E: It was reported that a burn pit was located outside of the camp but inside the wire, no other information or samples were available.

Super FOB KKC: It was reported that the burn pit was located approximately 200 ft from the nearest troop work and living area. It was unspecified as to who operated the burn pit other than there were multiple operators and the burn pit disposed of 750 pounds of waste a day. No other information or samples were available.

FOB Rushmore: There was no information available about the burn pit located at this site however there were two 24-hour PM_{10} samples taken near the burn pit in 2009 and 2013. The sample concentrations were 93 $\mu g/m^3$ and 132 $\mu g/m^3$. There was also one 24-hour $PM_{2.5}$ sample taken near the burn pit in 2013. The sample concentration was 10 $\mu g/m^3$. Due to the limited number of samples taken near the burn pits, a risk assessment could not be conducted.

Camp Yahya Khel: There was no information available about the burn pit located at this site however there was one 24-hour PM_{10} sample taken near the burn pit in 2011. The sample concentration was 658 $\mu g/m^3$. Due to the limited number of samples taken near the burn pits, a risk assessment could not be conducted.

FOB Sharana: Burn pits at FOB Sharana have been used since it was first occupied to dispose of municipal solid waste, debris, etc. FOB Sharana operated a five-bay burn pit facility located in the northeast part of the FOB near the Helicopter Landing Zone (HLZ). There was a DoD run HLZ, a contractor ran HLZ, fire station and a few guard towers near the burn pit. There were burn barrels on FOB Sharana located between 15 and 20 feet from the living quarters, gym, and the forward surgical team. Prevailing wind directions (East and Southeast) bring smoke and fumes over the FOB from the burn pit. The burn pit dimensions were 75 feet long x 50 feet wide and 20 feet deep. The burn pit was operated by Mayor Cell – Ecolog; the amount disposed of each day was unknown.

Particulate Matter, 10 micrometers (PM_{10})

Exposure Guidelines:

Short Term (24-hour) PM_{10} ($\mu g/m^3$):
- Negligible MEG = 250
- Marginal MEG = 420
- Critical MEG = 600

Long-term PM_{10} MEG ($\mu g/m^3$):
- Not defined and not available.

There were three 24-hour PM_{10} samples taken near the FOB Sharana burn pit in 2009. The samples' concentrations range was 186 to 679 $\mu g/m^3$ with an average concentration of 402 $\mu g/m^3$. Due to the limited number of samples taken near the burn pits, a risk assessment could not be conducted.

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

Exposure Guidelines:

Short Term (24-hour) $PM_{2.5}$ ($\mu g/m^3$):
- Negligible MEG = 65
- Marginal MEG = 250
- Critical MEG = 500

Long-term (1year) $PM_{2.5}$ MEGs ($\mu g/m^3$):
- Negligible MEG = 15
- Marginal MEG = 65.

There were two 24-hour $PM_{2.5}$ samples taken near the FOB Sharana burn pit in 2011 and 2013. The sample concentrations were 26 $\mu g/m^3$ and 118 $\mu g/m^3$. Due to the limited number of samples taken near the burn pits, a risk assessment could not be conducted.

Short-term and long-term health risks:

There was not enough data available to evaluate any burn pit specific health risk at the Rushmore and vicinity locations.

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, 2 December 2013.

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

8. 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. 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.

11. 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. Occupational and Environmental Health Site Assessment Base Camp Boris, Afghanistan, 22 June 2012.

13. Occupational and Environmental Health Site Assessment Base Camp Curry, Afghanistan, 20 February 2012.

[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. Occupational and Environmental Health Site Assessment FOB Kushamond, Afghanistan, 5 December 2011.

15. Occupational and Environmental Health Site Assessment Base Camp Margah, 18 June 2012.

16. Occupational and Environmental Health Site Assessment Camp Orgun-E-Sharana (Camp Orgun-E), 5 February 2012.

17. Occupational and Environmental Health Site Assessment Base Camp Rushmore, 11 April 2014.

18. Occupational and Environmental Health Site Assessment FOB Sharana, 18 July 2012.

19. Occupational and Environmental Health Site Assessment FOB Sharana, 27 May 2013

20. Occupational and Environmental Health Site Assessment Super FOB Khayr Kot Castle, 29 April 2013.

21. Environmental Conditions Report FOB Sharana, Afghanistan, USACE Forward Engineer Support Team, 6 February 2009.

12 Where Do I Get More Information?

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