Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Kandahar Airfield, Afghanistan
Calendar Years: (2002 to 2009)

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, *See REFERENCES.*

PURPOSE: This POEMS documents the DoD assessment of Occupational and Environmental Health (OEH) risk for Kandahar Airfield, Afghanistan. It presents a qualitative summary of health risks identified at this location and their potential medical implications. The report is based on information collected from 1 June 2002 through 30 September 2009 to include deployment OEHS sampling and monitoring data (e.g. air, water, and soil), field investigation and health assessment reports, as well as country and area-specific information on endemic diseases.

This assessment assumes that environmental sampling at Kandahar Airfield 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 11 June 2002 through 30 September 2009.

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

Kandahar Airfield is both a military and civil international airport. The existing airfield is currently controlled by U.S. Forces; however, the control tower is shared with the civilian control tower staff. It is located at the northern end of the Southwestern Plateau of Afghanistan, near the southern slopes of the Hindu Kush Mountains (the western most range of the Himalayan Chain). The elevation of Kandahar Airfield is about 1,000 meters above sea level. The existing base is being used by both International Security and Assistance Forces and U.S. Forces with a total population of approximately 5,300 personnel.

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 Kandahar Airfield. 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 may have caused acute health effects in some personnel during deployment at Kandahar Airfield:

Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}); food/waterborne diseases (e.g., bacterial diarrhea, Hepatitis A, Typhoid fever, Brucellosis, diarrhea-cholera, Hepatitis E); other endemic diseases (cutaneous leishmaniasis, Crimean-Congo hemorrhagic fever, Sandfly fever, Typhus-miteborne, Leptospirosis, Tuberculosis (TB), Rabies Anthrax, Q fever), heat stress, continuous noise, and burn pits. For food/waterborne diseases (e.g., bacterial diarrhea, hepatitis A, Typhoid fever, Brucellosis, diarrhea-cholera, Hepatitis E), if ingesting local food and water, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (Hepatitis A, Typhoid fever, Hepatitis E, and Brucellosis). For heat stress, risk can be greater for susceptible persons including those older than 45, of low fitness level, or with underlying medical conditions. Risks from food/waterborne diseases and heat stress may have been reduced with preventive medicine controls and mitigation, which includes Hepatitis A and Typhoid fever vaccinations. For other vector-born endemic diseases (cutaneous leishmaniasis, Crimean-Congo hemorrhagic fever, Sandfly fever, Typhus-miteborne), these diseases may constitute a significant risk due to exposure to biting vectors. For water contact diseases (Leptospirosis) activities involving extensive contact with surface water increase risk. For respiratory diseases (Tuberculosis (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 continuous noise exposure, the risk is to individuals working near major noise sources. Risk may have been reduced to the majority of personnel and to individuals working near major noise sources by using proper hearing protection. For PM_{10} and exposure to burn pits, exposures may result in mild to more serious short-term health effect (e.g., eye, nose or throat and lung irritation) in some personnel while at this site. For PM_{10}, 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. Although most effects from exposure to particulate matter and to burn pits 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 Kandahar Airfield. Personnel who reported with symptoms or required treatment while at this site should have exposure/treatment noted in medical record on a Standard Form (SF) 600 (*Chronological Record of Medical Care*).

Long-term health risks & medical implications:

The hazards associated with potential long-term health effects at Kandahar Airfield include:

The hazards associated with potential long-term health effects at Kandahar Airfield include inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$), and continuous noise. For continuous noise exposure, the long-term risk is to individuals working near major noise sources. Risk may have been reduced to the majority of personnel and to individuals working near major noise sources by using proper hearing protection. It is considered possible that some otherwise healthy personnel who were exposed for a long-term period to $PM_{2.5}$ levels 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 $PM_{2.5}$ exposures are documented and archived, at this time there are 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, or 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 – Kandahar Airfield[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 microns in diameter (PM_{10})	Short-term: Low to High: Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: Low to High: Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).
	Long-term: No health guidelines		Long-term: No health guidelines
Particulate matter less than 2.5 microns in diameter ($PM_{2.5}$)	Short-term: Low: A majority of the time mild acute health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in a few 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 health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in a few personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.
	Long-term: Moderate: Small percentage of persons may be at increased risk for developing chronic conditions (particularly those more susceptible to acute effects (e.g., those with asthma/existing respiratory diseases).		Long-term: Moderate: Small percentage of persons may be at increased risk for developing chronic conditions (particularly those more susceptible to acute effects (e.g., those with asthma/existing respiratory diseases).
WATER			
Consumed Water (Water Used for Drinking)	Short-term: Low: A majority of the time short-term health effects are not expected.	U.S. Army Public Health Command (USAPHC) former U.S. Army Veterinary Command (VETCOM) approved bottled water and potable water only from approved water sources	Short-term: Low: A majority of the time short-term health effects are not expected.
	Long-term: Not evaluated-adequate quantity of data is unavailable.		Long-term: Not evaluated-adequate quantity of data is unavailable.
Water for Other Purposes	Short-term: Low: A majority of the time short-term health effects are not expected.	Water treated in accordance with standards applicable to its intended use	Short-term: Low: A majority of the time short-term health effects are not expected.
	Long-term: None		Long-term: None
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) 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	Short-term: Low

	Long-term: Low for Leishmaniasis-visceral infection.	standing water and appropriate chemoprophylaxis.	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 CENTCOM GO 1B. Risks are further reduced in the event of assessed contact by prompt post-exposure rabies prophylaxis IAW The CDC's ACIP guidance.	Short-term: No data available
	Long-term: Low (Rabies)		Long-term: No data available
VENOMOUS ANIMAL/ INSECTS			
Snakes, scorpions, and spiders	Short-term: Low; If encountered, effects of venom vary with species from mild localized swelling (e.g. widow spider) to potentially lethal effects (e.g. central Asian saw-scaled viper).	Risk reduced by avoiding contact, proper wear of uniform (especially footwear), and proper and timely treatment.	Short-term: Low; If encountered, effects of venom vary with species from mild localized swelling (e.g. widow spider) to potentially lethal effects (e.g. central Asian saw-scaled viper).
	Long-term: No data available		Long-term: No data available
HEAT/COLD STRESS			
Heat	Short-term: High.	Work-rest cycles, proper hydration and nutrition, and WBGT monitoring.	Short-term: Moderate.
	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	Short-term: Low	Hearing protection used by personnel in higher risk areas	Short-term: Low
	Long-term: Low		Long-term: Low
Unique Incidents/ Concerns			
Pesticides/Pest Control	Short-term: Low	See Section 10.4	Short-term: Low
	Long-term: Low		Long-term: Low

Asbestos	Short-term: Low	See Section 10.5	Short-term: Low
	Long-term: Low		Long-term: Low
Lead Based Paint	Short-term: Low	See Section 10.6	Short-term: Low
	Long-term: Low		Long-term: Low
Burn Pits	Short-term: Low to High. Short-term health effects could include eye, nose, throat, and lung irritation.	Control measures may have included locating burn pits downwind of prevailing winds, increased distance from living and working areas when possible, and improved waste segregation and management techniques	Short-term: Low to High. Short-term health effects could include eye, nose, throat, and lung irritation.
	Long-term: Low		Long-term: Low

[1]This Summary Table provides a qualitative estimate of population-based short- and long-term health risks associated with the occupational environment conditions at Kandahar Airfield. 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 11 June 2002 through 30 September 2009. 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 Kandahar Airfield. 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 APHC/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 Kandahar Airfield, Afghanistan by Source

The following sections provide additional information about the OEH conditions summarized above. All risk assessments were performed using the methodology described in the US Army Public Health Command Technical Guide 230, *Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel* (USAPHC TG 230). 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

Personnel deployed to Kandahar Airfield are exposed to various airborne contaminants. These have been identified through monitoring and sampling efforts between June 2002 and September 2009. Windblown dust and sand contribute to PM exposures above health-based MEGs at Kandahar Airfield. There are a number of industrial activities, primarily the operation of an international airport but also including construction, fuel storage and distribution, water and wastewater treatment, and power production located on and around Kandahar Airfield that may contribute air contaminants. An additional source of exposure to contaminants in the air comes from the Army's use of open burn pits and incinerators to dispose of solid waste/refuse. Burn pit workers, tower guards and any other personnel that work at or in close proximity of the burn pits or other sources may have a higher risk of exposure to burn pit emissions than the general population at Kandahar Airfield.

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 micron ($PM_{2.5}$), 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 than 10 micrometers (PM_{10})

2.3.1 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.

2.3.2 Sample data/Notes:

A total of 109 valid PM_{10} air samples were collected from June 2002 to September 2009. The range of 24-hour PM_{10} concentrations was 54 to 2437 µg/m^3 with an average of 526 µg/m^3.

2.3.3 Short-term health risks:

Variable (Low to High). Short-term risk is based on comparison of daily concentrations to 24-hour MEGs. The variable risk is due to significant fluctuation in daily concentrations. Risk from peak exposures was High in 2002, 2004, 2005, 2006, and 2009. Risk from typical exposures was High in 2004 and 2005, while it was Low in 2002, 2006, and 2009. All other years had no data available. PM_{10} concentrations were below the short-term Negligible MEG indicating no acute hazard on 13 percent of the days sampled. Of the remaining days sampled, daily PM_{10} levels exceeded a Negligible, Marginal or Critical MEG resulting in Low risk on 40 percent of the days sampled, Moderate risk on 15 percent of the days sampled and High risk on 30 percent of the days sampled. Respiratory effects can increasingly impact real-time health and mission capabilities as they exceed higher levels of MEGs. Acute effects to relatively healthy troops are mostly eye, nose, and throat irritation, and respiratory effects (sneezing, adaptive responses such as coughing, sinus congestion and drainage) that can be exacerbated by increased activity. These effects are consistent with those generally reported from the field. Confidence in the risk estimate is moderate.

2.3.4 Long-term health risk:

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

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

2.4.1 Exposure Guidelines:

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

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

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

- Negligible MEG = 15
- Marginal MEG = 65.

2.4.2 Sample data/Notes:

A total of 18 valid $PM_{2.5}$ air samples were collected from September 2008–September 2009. The range of 24-hour $PM_{2.5}$ concentrations was 74 to 219 µg/m^3 with an average of 132 µg/m^3.

2.4.3 Short-term health risks:

Low. Short-term risk is based on comparison of daily concentrations to 24-hour MEGs. For the all of the days sampled (100%), $PM_{2.5}$ concentrations were below the short-term Marginal MEG indicating Low risk. Risk from peak and typical exposures was Low in 2006 and 2009. All other years had no data available. During the highest levels of $PM_{2.5}$, a few personnel may have experienced notable eye, nose, or throat irritation; most personnel would have experienced only mild effects. Pre-existing health conditions (e.g., asthma or cardiovascular diseases) may have been exacerbated. Confidence in the risk estimate is low due to limited field data.

2.4.4 Long-term health risks:

Moderate. Long-term risk is based on comparison of the average sample concentration to the long-term MEGs. Unlike PM_{10}, chronic $PM_{2.5}$ exposures are potentially associated with certain long-term health consequences. The average $PM_{2.5}$ concentration for samples collected was 132 µg/m^3, which is above the marginal long-term MEG of 65 µg/m^3. Risk was Moderate in 2006 and 2009. All other years had no data available. With repeated exposures above this level, the risk that a small percentage of susceptible personnel may develop chronic conditions (such as, reduced lung function or exacerbated chronic bronchitis, chronic obstructive pulmonary disease [COPD], asthma, atherosclerosis, or other cardiopulmonary diseases) increases. Those with a history of asthma or cardiopulmonary disease have a higher risk for developing these chronic conditions. Confidence in risk estimate is low due to limitations in field data and health effects data.

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

2.5.1 Sample data/Notes:

A total of 109 valid PM_{10} airborne metal samples were collected at Kandahar Airfield from June 2002 to September 2009. A total of 18 valid $PM_{2.5}$ air samples were collected from 2 September 2008 to September 2009. None of the analyzed metals were found at concentrations above short or long-term MEGs.

2.5.2 Short- and long-term health risks:

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

2.6 Volatile Organic Compounds (VOCs)

2.5.1 Sample data/Notes:

A total of 14 valid VOC airborne samples were collected at Kandahar Airfield from June 2002 to October 2006. None of the VOCs were found at concentrations above short or long-term MEGs.

2.5.2 Short- and long-term health risks:

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

3 Soil

3.1 Site-Specific Sources Identified

3.2 Sample data/Notes:

A total of 5 valid soil samples were collected from February 2002 to March 2009, to assess OEH health risk to deployed personnel. The primary soil contamination exposure pathways were dermal contact and dust inhalation. Typical parameters analyzed for included SVOCs, heavy metals, 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 were assumed to remain at this location for 6 months to 1 year.

3.3 Short-term health risk:

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

3.4 Long-term health risk:

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

4 Water

In order to assess the health risk to U.S. personnel from exposure to water in theater, the APHC identified the most probable exposure pathways. These were based on the administrative information provided on the field data sheets submitted with the samples taken over the time period being evaluated. Routine field tests conducted by Preventive Medicine and Veterinary personnel and contractors include bacteriological and physical inspections. Note that gross alpha and gross beta radiological results are not included in the health risks.

4.1 Drinking Water: Bottled and ROWPU Water

4.1.1 Site-Specific Sources Identified

Based on the information provided from the field, bottled water is the primary source of all drinking water for U.S. personnel at Kandahar Airfield. Historically, the bottled water has come from Masafi® Mineral Water Company (Masafi®, Viva Water Company, Oasis Water Company, Ghadeer Mineral Water Company (Dibba), and Jeema Mineral Water Company located in the United Arab Emirates, from Tanuf National Mineral Water Company located in Oman, from Kinley® Mineral Water (Kinley®, Habib Gulzar Non-Alcoholic Beverages, LTD) located in Afghanistan, from Nestle® Waters, the Healthy Hydration Company™ (Nestle® Société des Produits Nestlé S.A.) located in Pakistan, and from Afghan Beverage Industries Limited (Cristal®, Afghanistan Beverage Industries, LTD) located in Afghanistan. Currently, U.S. personnel use the ROWPU-treated water supply at Kandahar Airfield for personal hygiene, showering, and cooking.

4.1.2 Sample data/Notes:

To assess the potential for adverse health effects to troops the following assumptions were made: All U.S. personnel at these locations were assumed to remain at this site for approximately 1 year. A conservative (protective) assumption was that personnel routinely consumed less than 15L/day of bottled water for up to 365 days (1-year). It was further assumed that control measures and/or personal protective equipment were not used.

A total of 17 total water samples were submitted to the AIPH for analysis. Bottled water samples were received in 2004, 2005 and 2009. ROWPU-treated water used as secondary drinking water sources samples were received in 2004, 2005, and 2007. These samples will be considered together for health risks from water used for drinking. Only boron was found at concentrations above a long-term MEG.

4.1.3 Short-term health risk:

Low: After the pre-screen the only hazard identified was boron. At both typical and peak exposures, personnel are unlikely or seldom to be exposed to levels that would result in a negligible severity for boron. This indicates a Low risk where few, if any, personnel are expected to have noticeable health effects during the mission from boron. This Low risk estimate is based on a low to medium confidence

level due to limited sampling data. Risk was Low for peak and typical exposures in 2004 and 2007. No hazards were identified for any other of the sampled years.

4.1.4 Long-term health risks:

None identified based on available sample data. Data were insufficient to characterize health risk associated with boron exposure.

4.2 Non-Drinking Water

4.2.1 Site-Specific Sources Identified

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

4.2.2 Sample data/Notes:

To assess the potential for adverse health effects to troops the following assumptions were made: All U.S. personnel at these locations were expected to remain at this site for approximately 1 year. A conservative (protective) assumption was that personnel routinely consumed less than 5L/day of non-drinking water for up to 365 days (1-year). It was further assumed that control measures and/or personal protective equipment were not used.

As of March 2010, the ROWPU-treated water supply at Kandahar Airfield is used for nondrinking purposes (i.e., cooking, personal hygiene, and showering, etc.) by U.S. personnel and the raw well water supply at Kandahar Airfield is used for nondrinking purposes (i.e., personal hygiene and showering) by U.S. personnel. Note that gross alpha and gross beta radiological results are not included in the health risks.

A total of ten water samples used for nondrinking purposes (i.e., personal hygiene, cooking, showering, etc.) were collected from Kandahar Airfield and submitted to a laboratory for analysis. Samples used as a nondrinking water source were received in 2005 and 2009 from ROWPU-treated water sources and in 2005 from untreated, raw well water sources. Only sulfate was found at concentrations above a long-term MEG.

4.2.3 Short-term health risks:

Low. After the pre-screen the only hazard identified was sulfate. At both typical and peak exposures, personnel are seldom or occasionally exposed to levels that would result in a negligible severity for sulfate. This indicates a Low risk where few, if any, personnel are expected to have noticeable health effects during the mission from sulfate. This Low risk estimate is based on a low to medium confidence level due to limited sampling data. Risk was Low for peak and typical exposures in 2005. No hazards were identified for any other of the sampled years.

4.2.4 Long-term health risks:

None identified based on available sample data. No hazards were identified for long-term health risks, therefore there is no long-term health risk associated with the nondrinking water samples

collected from Kandahar Airfield. Confidence in this conclusion is low to medium due to limited 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 Environmental Surveillance Library (MESL) from the 1 June 2002 through 30 September 2009 timeframe.

5.2 Depleted Uranium (DU)

No specific hazard sources were documented in the DOEHRS, or MESL from the 1 June 2002 through 30 September 2009 timeframe.

5.3 Ionizing Radiation

The Environmental Site Survey and Operational Health Risk Assessment from June 2002 reported very small amounts of non-US origin radiological material were present at Kandahar Airfield. The radiation hazard from this material is well below any health guidelines and represents no threat to deployed personnel. No radiological precautions are necessary for personnel at Kandahar Airfield. The health threat from radiological contamination at Kandahar Airfield is insignificant.

5.4 Non-Ionizing Radiation

No specific hazard sources were documented in the DOEHRS, or MESL from the 1 June 2002 through 30 September 2009 timeframe.

6 Endemic Disease

This document lists the endemic diseases reported in the region, its specific health risks and severity and general health information about the diseases. USCENTCOM MOD 11 (Reference 12) 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 were transmitted through the consumption of local food and water. Local unapproved food and water sources (including ice) were heavily contaminated with pathogenic bacteria, parasites, and viruses to which most U.S. Service Members had little or no natural immunity. Effective host nation disease surveillance did not exist within the country. Only a small fraction of diseases were identified or reported in host nation personnel. Diarrheal diseases were expected to temporarily incapacitate a very high percentage of U.S. personnel within days if local food, water, or ice were consumed. Hepatitis A and typhoid fever infections typically cause prolonged illness in a smaller percentage of unvaccinated personnel. Vaccinations were 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 have occurred. 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 were expected to temporarily incapacitate a very high percentage of personnel (potentially over 50% per month) within days if local food, water, or ice was consumed. Field conditions (including lack of hand washing and primitive sanitation) may have facilitated person-to-person spread and epidemics. Typically mild disease was treated in outpatient setting; recovery and return to duty in less than 72 hours with appropriate therapy. A small proportion of infections may have required 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 was 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 have caused prolonged illness in a small percentage of personnel (less than 1% per month). Although much rarer, other potential diseases in this area that were also considered a Moderate risk include: hepatitis E, diarrhea-cholera, and brucellosis.

6.1.3 Short-term Health Risks:

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

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

6.2.1 Malaria

High, mitigated to Low Potential unmitigated risk to U.S. personnel was High during warmer months (typically April through November) but reduced to low with mitigation measures. Malaria incidents were 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 have occurred among personnel exposed to mosquito (Anopheles spp.) bites. Malaria incidents may have caused debilitating febrile illness typically requiring 1 to 7 days of inpatient care, followed by return to duty. Severe cases may have required intensive care or prolonged convalescence.

6.2.2 Leishmaniasis

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

6.2.3 Crimean-Congo hemorrhagic fever

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

6.2.4 Sandfly fever

Moderate, mitigated to Low: Sandfly fever had 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 was 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 was Low year round. Bubonic plague typically occurred as sporadic cases among people who come in contact with wild rodents and their fleas during work, hunting, or camping activities. Outbreaks of human plague were 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 have developed into secondary pneumonic plague. Respiratory transmission of pneumonic plague was rare but has the potential to cause significant outbreaks. Close contact was usually required for transmission. In situations where respiratory transmission of plague was suspected, weaponized agent must be considered. Extremely rare cases (less than 0.01% per month attack rate) could have occurred. Incidence could have resulted in potentially severe illness which may have required more than 7 days of hospitalization and convalescence.

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

Moderate, mitigated to Low: Potential health risk to U.S. personnel was Moderate during warmer months (typically March through November) when vector activity was highest. Mitigation measures reduced the risk to low. Mite-borne typhus was 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 was 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 have included sandy beaches, mountain deserts, cultivated rice fields, and rain forests. Although data were insufficient to assess potential disease rates, attack rates could have been very high (over 50%) in groups of personnel exposed to heavily infected "mite islands" in focal areas. The

disease could have caused 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 was present. The disease was 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 could have occurred. This disease was associated with a low risk estimate.

6.2.9 Short -term health risks:

Low: The unmitigated health risk estimate was 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 was reduced to low by proper wear of the uniform, application of repellent to exposed skin, and appropriate chemoprophylaxis. Confidence in health risk estimate was high.

6.2.10 Long-term health risks:

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

6.3 Water Contact Diseases

Operations or activities that involved extensive water contact may have resulted in personnel being temporarily debilitated with leptospirosis in some locations. Leptospirosis health risk typically increased during flooding. In addition, although not specifically assessed in this document, bodies of surface water were likely to be contaminated with human and animal waste. Activities such as wading or swimming may have resulted in exposures to enteric diseases such as diarrhea and hepatitis via incidental ingestion of water. Prolonged water contact also may have 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 occurred seasonally (typically April through November) through exposure to water or soil contaminated by infected animals and was associated with wading, and swimming in contaminated, untreated open water. The occurrence of flooding after heavy rainfall facilitated the spread of the organism because as water saturates the environment leptospirosis present in the soil passes directly into surface waters. Leptospirosis can enter the body through cut or abraded skin, mucous membranes, and conjunctivae. Infection may have also occurred 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 included fever, chills, myalgia, nausea, diarrhea, cough, and conjunctival suffusion. Manifestations of severe disease could have included jaundice, renal failure, hemorrhage, pneumonitis, and hemodynamic collapse. Recreational activities involving extensive water contact may have resulted in personnel being temporarily debilitated with leptospirosis. Incidence could have resulted in debilitating febrile illness typically requiring 1 to 7 days of inpatient care, followed by return to duty; some cases may have required prolonged convalescence. This disease was associated with a

Moderate health risk estimate.

6.3.2 Short-term health risks:

Low: Unmitigated Health risk of leptospirosis was Moderate during warmer months. Mitigation measures reduced the risk to Low. Confidence in the health risk estimate was 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 have been exposed to a wide variety of common respiratory infections in the local population. These included influenza, pertussis, viral upper respiratory infections, viral and bacterial pneumonia, and others. The U.S. military populations living in close-quarter conditions were at risk for substantial person-to-person spread of respiratory pathogens. Influenza was 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 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 was Moderate, mitigated to Low, year round. Transmission typically required close and prolonged contact with an active case of pulmonary or laryngeal tuberculosis (TB), although it also could have occurred 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 posed a Low risk and was transmitted from person to person through droplets of respiratory or throat secretions. Close and prolonged contact facilitated the spread of this disease. Meningococcal meningitis was potentially a very severe disease typically requiring intensive care; fatalities may have occurred 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 was high.

6.4.4 Long-term health risks:

None identified based on available data. Tuberculosis was evaluated as part of the Post Deployment Health Assessment (PDHA). A TB skin test was required post-deployment if potentially exposed and was 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 have occurred from scratches contaminated with the saliva. A U.S. Army Soldier stationed in Afghanistan died of rabies on 31 August 2011 (Reference 13). 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 were rare in indigenous personnel, and posed 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 have resulted in contracting gastrointestinal anthrax. Pulmonary anthrax was contracted through inhalation of spores and was 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 was Moderate, but mitigated to Low, year round. Rare cases were possible among personnel exposed to aerosols from infected animals, with clusters of cases possible in some situations. Significant outbreaks (affecting 1-50%) could have occurred in personnel with heavy exposure to barnyards or other areas where animals are kept. Unpasteurized milk may have also transmitted infection. The primary route of exposure was respiratory, with an infectious dose as low as a single organism. Incidence could have resulted 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 was 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 have occurred. Incidence could have resulted 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 was 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 was high.

6.5.6 Long-term health risks:

Low: A Low long term risk existed 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 Clinical Toxinology Resources web site from the University of Adelaide, Australia (Reference 2). The species listed below have home ranges that overlap the location of Kandahar Airfield and may have presented a health risk if they were encountered by personnel. See Section 9 for more information about pesticides and pest control measures.

7.1 Spiders

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

7.2 Scorpions

- Androctonus amoreuxi, and Androctonus baluchicus: Severe envenoming possible, potentially lethal. Severe envenoming may produce direct or indirect cardio toxicity, with cardiac arrhythmias, cardiac failure. Hypovolaemic hypotension possible in severe cases due to fluid loss through vomiting and sweating.
- Compsobuthus rugosulus, Mesobuthus caucasicus, Mesobuthus eupeus, Mesobuthus macmahoni, Orthochirus bicolor, Orthochirus danielleae, Orthochirus erardi, Orthochirus pallidus, Orthochirus scrobiculosus, and Sassanidotus gracilis: There are a number of dangerous Buthid scorpions, but also others known to cause minimal effects only. Without clinical data it is unclear where these species fit within that spectrum.
- Hottentotta alticola, and Hottentotta saulcyi: Moderate envenoming possible but unlikely to prove lethal. Stings by these scorpions are likely to cause only short lived local effects, such as pain, without systemic effects.

7.3 Snakes

- 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) and Echis sochureki (Sochurek's saw-scaled viper): Severe envenoming possible, potentially lethal. Bites may cause moderate to severe coagulopathy and haemorrhagins causing extensive bleeding.
- Hemorrhis ravergieri (mountain racer) and Psammophis lineolatus (Teer snake): Unlikely to cause significant envenoming. Bites require symptomatic treatment only.
- Platyceps rhodorachis (Jan's desert racer): Mild envenoming only, not likely to prove lethal. Requires symptomatic treatment only.
- Pseudocerastes persicus (Persian dwarf snake): Unlikely to cause significant envenoming; limited clinical data suggest bites result in local effects only.

7.4 Short-term health risk:

Low: If encountered, effects of venom vary with species from mild localized swelling (e.g. widow spider) to potentially lethal effects (e.g. central Asian saw-scaled viper). See effects of venom above. Confidence in the health risk estimate is low.

7.5 Long-term health risk:

None identified.

8 Heat/Cold Stress

Kandahar has a continental warm arid climate characterized by little precipitation and high variation between summer and winter temperatures. Sunny weather dominates year-round, especially in summer, when rainfall is extremely rare.

8.1 Heat

Average monthly peak temperature during the summer months (June – September) was 104.4 °F. The health risk of heat stress/injury based on temperatures alone was Low (< 78 °F) from November – March, moderate (78-82 °F) in October, high (82-87.9 °F) in April, and extremely high (≥ 88 °F) from May – September. However, work intensity and clothing/equipment worn posed greater health risk of heat stress/injury than environmental factors alone (Reference 6).

8.1.1 Short-term health risk:

Moderate to High: High health risk of heat injury in unacclimatized personnel from April – September, Moderate for October, and Low for all other months. The risk of heat injury was reduced through preventive measures. Because the occurrence of heat stress/injury was strongly dependent on operational factors (work intensity and clothing), confidence in the health risk estimate is low (Reference 9, Table 3-6).

8.1.2 Long-term health risk:

Low: Long-term health implications from heat injuries were rare but could occur, especially from more serious injuries such as heat stroke. However, the health risk may have been greater to certain susceptible persons–those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions. The long-term health risk was Low; confidence in the health risk estimates is medium (Reference 9, Table 3-6).

8.2 Cold

Winter (December – March) low temperatures ranged from 33.8 °F to 36.3 °F. Even on warm days there could be a significant drop in temperature after sunset by as much as 40 °F. There was a risk of cold stress/injury when temperatures fell below 60 °F, which could occur from September – April. The health risk assessment for non-freezing cold injuries (chilblain, trench foot, and hypothermia) was Low based on historical temperature and precipitation data. Frostbite was unlikely to occur because temperatures rarely dropped below freezing. However, personnel may have encountered significantly lower temperatures during field operations at higher altitudes. As with heat stress/injuries, cold stress/injuries were largely dependent on operational and individual factors instead of environmental factors alone. With protective measures in place the health risk assessment was low for cold stress/injury; confidence in the health risk estimate is medium.

8.2.1 Short-term health risks:

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

8.1.2 Long-term health risk:

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

9 Noise

9.1 Continuous

Noise evaluation from the Environmental Site Survey and Operational Health Risk Assessment (2002) indicate combined noise sources at the site generate noise levels that are equivalent to a large city or industrial facility. Noise levels are not appreciably lower during the overnight hours. Major noise sources (the power generation facilities and the ROWPU area) were sufficiently removed from personnel locations and have no effect on the general population. Hearing protection is required by personnel working in sources of major noise. The flightline/taxiway of the airfield, airport terminal walkways, Army cargo staging area and guard towers are potential specific noise hazards and hearing protection is highly recommended in these areas during active flightline/taxiway operations.

9.1.1 Short and long-term health risks:

Low for the majority of personnel on this site. **Moderate** for individuals working near major noise sources without proper hearing protection. Risk is reduced to Low through use of proper hearing protection. Confidence in these risk estimates is low to medium.

9.2 Impulse

No specific hazard sources were documented in the DOEHRS, or MESL from the 1 June 2002 through 30 September 2009 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

As of 2002, regulated medical waste was stored, transported and disposed of following proper Coalition Forces Land Component Command guidance. This disposal procedure included burning regulated medical waste in a burn pit and then burying the regulated medical waste. A regulated medical waste incinerator is currently employed to dispose of regulated medical waste. No specific hazard sources were documented in the DOEHRS, or MESL from the 1 June 2002 through 30 September 2009 timeframe.

10.3 Fuel/petroleum products/industrial chemical spills

There are numerous aboveground storage tanks on Kandahar Airfield, in addition to a bulk fuel storage area and aerial refueling point. No specific hazard sources were documented in the DOEHRS, or MESL from the 1 June 2002 through 30 September 2009 timeframe.

10.4 Pesticides/Pest Control:

There are historical reports of mosquitoes, ticks, and sandflies on site which are controlled for through the application of pesticides. Several monthly Pesticide Application Reports in the DOD OEHS Data Portal for Kandahar Airfield January 2003-September 2009 list the usage of pesticides on the site.

10.4.1 Short-term and Long-term health risks:

Low.

10.5 Asbestos

The Aviation Maintenance Facility and adjacent boiler room are known to contain friable asbestos containing material (ACM). Bulk ACM was reportedly found in the Vehicle Maintenance Facility but sampled materials contained no ACM. All areas air samples collected for airborne asbestos fiber analysis were below Occupational Safety and Health Administration and Overseas Environmental Baseline Guidance Document permissible limits. Based on these results, airborne asbestos fibers at these facilities do not pose a health threat to personnel working at these areas.

10.5.1 Short-term and Long-term health risks:

Low.

10.6 Lead Based Paint

Lead Based Paint was detected in one compound kitchen at Kandahar Airfield. Due to the location of the sampled area (food preparation and handling) there is a potential for a health risks to personnel. Procedures have been established to limit exposures (i.e., cleaning with a High Efficiency Particulate Air filtered vacuum, repaint with an interior grade latex paint).

10.6.1 Short-term and Long-term health risks:

Low.

10.7 Burn Pit

While not specific to Kandahar Airfield, 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 7). The committee's 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.

Open burn pits are located at Kandahar Airfield and are used for some solid waste disposal, though the solid waste disposal is also done through the use of incinerators. Burn pit workers, tower guards and any other personnel that work at or in close proximity of the burn pits may have a higher risk of exposure to burn pit emissions than the general population at Kandahar Airfield.

An additional limited evaluation was done following the same TG230 method on available air samples only taken at or around the burn pits at Kandahar Airfield. The risk for these samples is noted below. Dioxins, furans, polycyclic aromatic hydrocarbons, acid gases, and many typical combustion byproducts have not been characterized. The samples were only analyzed for PM_{10}, $PM_{2.5}$ metals and select volatile chemicals. There were only three burn pit samples analyzed for $PM_{2.5}$ (from July-September 2009) and the range of 24-hour $PM_{2.5}$ concentrations was 185 to 219 $\mu g/m^3$ with an average of 205 $\mu g/m^3$. There were ten burn pit samples taken for PM_{10} concentrations (from June-September 2009) and the range was 214 to 978 $\mu g/m^3$ with an average of 475 $\mu g/m^3$. The only detected metals out of these ten PM_{10} samples were antimony, chromium, lead, manganese, nickel, and zinc. None of these detected metals exceeded its 1-year negligible MEG and all were eliminated from any further assessment.

10.7.1 Short-term health risks:

Low to High. The variable risk is due to significant fluctuation in daily concentrations. The typical short-term risk levels for PM_{10} is Moderate and the peak risk level for PM_{10} is High. Both the typical short-term risk levels and peak risk levels for $PM_{2.5}$ are Low. Respiratory effects can increasingly impact real time effects to relatively healthy troops are mostly eye, nose, and throat irritation and respiratory effects (sneezing, adaptive responses such as coughing, sinus congestion and drainage) that can be exacerbated by increased activity. These effects are consistent with those generally reported from the field. There is low to medium confidence in this risk estimate based on limited sampling data.

10.7.2 Long-term health risks:

Low. Long-term health effects from exposure to $PM_{2.5}$ do not require specific medical action. Long-term health effects from unmeasured chemicals is unknown. There is low to medium confidence in this risk estimate based on limited sampling data.

11 References[1]

1. Casarett and Doull's Toxicology: the Basic Science of Exposures, Chapter 2- Principles of Toxicology; Fifth Edition, McGraw Hill, New York.

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

3. 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.

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

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. 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.

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

8. Joint Staff Memorandum (MCM) 0028-07, Procedures for Deployment Health Surveillance, 2007.

9. USA PHC TG230, June 2010 Revision.

10. USACHPPM. 2008. Particulate Matter Factsheet; 64-009-0708, 2008.

11. Modification 11 to United States Central Command Individual Protection and Individual Unit Deployment Policy, 2 December 2011.

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

12 Where Do I Get More Information?

[1] NOTE. The data are currently assessed using the 2010 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.

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