Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Bagram Air Field, Afghanistan
Calendar Years: (2002 to 2010)

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 Department of Defense (DoD) assessment of occupational and environmental health (OEH) risk for Bagram Air Field. 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 19 January 2002 through 30 October 2010 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 Bagram Air Field 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 1 January 2002 through 31 October 2010.

The POEMS can be useful to inform healthcare providers and others of environmental conditions experienced by individuals deployed to Bagram Air Field 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: The BAF is located in the Parwan Province of northern Afghanistan approximately 11 km southwest of the city of Charikar, 47 km north of Kabul and is situated approximately 1,500 m above sea level. The climate is semi-arid with precipitation (snow and rain) concentrated in the winter months. Weather conditions can vary widely with temperature ranging from 21 - 33 °C (70 – 91 °F) in the summer months, and -7 – 10 °C (19 – 50 °F). Strong winds (above 25 knots) can create intense dust storms, especially during the spring and summer. The airfield is approximately 38,000 acres in size and has an 11,820 foot runway serving as a hub for air freight and the movement of military personnel for eastern Afghanistan, and receives and stages larger freight transported overland from the Port of Karachi. The BAF has three large hangers, a control tower, and numerous support buildings.

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 Bagram Air Field. 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 health effects in some personnel during deployment at Bagram Air Field:

The following may have caused acute health effects in some personnel during deployment at BAF:
Inhalable coarse particulate matter less than 10 micrometers in diameter (PM10); inhalable fine particulate matter less than 2.5 micrometers in diameter (PM2.5); food/waterborne diseases (e.g., bacterial diarrhea, Hepatitis A, Typhoid fever, Brucellosis, diarrhea-cholera, diarrhea-protozoal Hepatitis E); other endemic diseases (cutaneous leishmaniasis, Crimean-Congo hemorrhagic fever, Sandfly fever, Typhus-miteborne, Leptospirosis, Tuberculosis (TB), Rabies, Anthrax, Q fever); venomous insects and animals (e.g., snakes, scorpions, spiders); heat stress, 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. Risk of heat injury is reduced through preventive measures. Risks from food/waterborne diseases may have been reduced with preventive medicine controls and mitigation, which includes Hepatitis A and Typhoid fever vaccinations. For other vector-borne 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 venomous insects and animals, if encountered, effects of venom vary with species from mild localized swelling to potentially lethal effects. For PM10, PM2.5, and exposure to burn pits, exposures 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. For PM10 and PM2.5, 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. 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 Bagram Air Field. 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 following hazards may be associated with potential chronic health effects in some personnel during deployment at Bagram Air Field:

The hazards associated with potential long-term health effects at Bagram Air Field include inhalable fine particulate matter less than 2.5 micrometers in diameter (PM2.5). It is considered possible that some otherwise healthy personnel who were exposed for a long-term period to PM2.5 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 PM2.5 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 – Bagram Air Field[1, 2]

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
AIR			
Particulate matter less than 10 micrometers in diameter (PM_{10})	Short-term: Low to High, Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/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 micrometers in diameter ($PM_{2.5}$)	Short-term: Low to High, A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: Low to High, 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: Low to 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/existing respiratory diseases).		Long-term: Low to 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/existing respiratory diseases).
Metals	Short-term: Low		Short-term: Low
	Long-term: Low		Long-term: Low
Water			
Consumed Water (Water Used for Drinking)	Short-term: Low	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
	Long-term: Low		Long-term: Low
Military Unique			
Ionizing Radiation	Short-term: None identified		Short-term: None identified
	Long-term: Low		Long-term: Low
ENDEMIC DISEASE			
Food borne/Waterborne (e.g., diarrhea-bacteriological)	Short-term: Variable; High (bacterial diarrhea, hepatitis A, typhoid fever) to Moderate (diarrhea-cholera, diarrhea-protozoal, brucellosis, hepatitis E) 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's (CDC) Advisory Committee on Immunization Practices guidance.	Short-term: No data available
	Long-term: Low (Rabies)		Long-term: No data available
VENOMOUS ANIMAL/ INSECTS			
Snakes, scorpions, and spiders	Short-term: Low; If encountered, effects of venom vary with species from mild localized swelling (e.g. widow spider) to potentially lethal effects (e.g. Haly's Pit 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. Haly's Pit Viper).
	Long-term: No data available		Long-term: No data available
HEAT/COLD STRESS			
Heat	Short-term: Variable; Risk of heat injury is High for July-August, Moderate for June and Low for all other months.	Work-rest cycles, proper hydration and nutrition, and Wet Bulb Globe Temperature (WBGT) monitoring.	Short-term: Variable; Risk of heat injury in unacclimatized or susceptible personnel is Moderate for July-August and Low for all others.
	Long-term: Low, The long-term risk was Low. However, the risk may be greater to certain susceptible persons– those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.		Long-term: Low, The long-term risk is Low. However, the risk may be greater to certain susceptible persons– those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.

Cold	Short-term: Low risk of cold stress/injury. Long-term: Low; Long-term health implications from cold injuries are rare but can occur, especially from more serious injuries such as frost bite.	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.
NOISE			
Continuous (Flightline, Power Production)	Short-term: Low Long-term: Low to Moderate	Hearing protection used by personnel in higher risk areas	Short-term: Low Long-term: Low
Unique Incidents/ Concerns			
Pesticides/Pest Control	Short-term: Low Long-term: Low	See Section 10.4	Short-term: Low Long-term: Low
Asbestos	Short-term: None identified Long-term: Low		Short-term: None identified Long-term: Low
Burn Pits	Short-term: Low to High Long-term: Low to Moderate	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 Long-term: Low to Moderate

[1]This Summary Table provides a qualitative estimate of population-based short- and long-term health risks associated with the occupational environment conditions at Bagram Air Field. 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 19 January 2002 through 30 October 2010. 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 Bagram Air Field. 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/U.S. 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 Bagram Air Field, 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

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

2.2 Particulate matter

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

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

2.3.1 Exposure Guidelines:

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

- 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 448 ambient and 8 fuel area valid PM_{10} air samples were collected from 2002 – 2010. The range of 24-hour PM_{10} concentrations was 4 $\mu g/m^3$ – 1416 $\mu g/m^3$ with an average concentration of 302 $\mu g/m^3$.

2.3.3 Short-term health risks:

Variable (Low to High): The short-term PM_{10} health risk assessment is Low based on average and High based on peak PM_{10} sample concentrations, and the likelihood of exposure at these hazard severity levels. A Low health risk assessment is expected to have little or no impact on accomplishing the mission (TG 230 Table 3-2). A High health risk assessment is expected to have significant degradation of mission capabilities in terms of the required mission standard, inability to accomplish all parts of the mission, or inability to complete the mission to standard if hazards occur during the mission (TG 230 Table 3-2). Daily average health risk levels for PM_{10} show no hazard for 57%, low health risk for 27%, moderate health risk for 9%, and high health risk for 7% of the time. Confidence in the short-term PM_{10} health risk assessment is low to medium (Reference 9, Table 3-6).

The hazard severity for average PM_{10} concentrations in samples was negligible. The results indicate that a few personnel may experience notable mild eye, nose, or throat irritation; most personnel will experience only mild effects. Pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated (Reference 9, Table 3-10).

For the highest observed PM_{10} sample concentration, the hazard severity was critical. During peak exposures at the critical hazard severity level, most if not all personnel will experience very notable eye, nose, and throat irritation and respiratory effects. Visual acuity is impaired, as is overall aerobic capacity. Some personnel will not be able to perform assigned duties. Some lost-duty days are expected. Those with a history of asthma or cardiopulmonary disease will experience more severe symptoms. Conditions may also result in adverse, non-health related materiel/logistical impacts (Reference 9, Table 3-10).

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:

A total of 441 ambient and 8 fuel area valid $PM_{2.5}$ air samples were collected from 2005 – 2010. The range of 24-hour PM_{10} concentrations was 14 $\mu g/m^3$ – 1967 $\mu g/m^3$ with an average concentration of 105 $\mu g/m^3$.

2.4.3 Short-term health risks:

Variable (Low to High): The short-term $PM_{2.5}$ health risk assessment is Low to Moderate based on average and Low to High based on peak $PM_{2.5}$ sample concentrations, and the likelihood of exposure at these hazard severity levels. A Low health risk assessment is expected to have little or no impact on

accomplishing the mission (TG 230 Table 3-2). A High health risk assessment is expected to have significant degradation of mission capabilities in terms of the required mission standard, inability to accomplish all parts of the mission, or inability to complete the mission to standard if hazards occur during the mission (TG 230 Table 3-2). Daily average health risk levels for PM_{10} show no hazard for 35%, low health risk for 64% and moderate health risk for 1%, of the time. Confidence in the short-term PM_{10} health risk assessment is low to medium (Reference 9, Table 3-6).

The hazard severity for average $PM_{2.5}$ concentrations in samples was negligible. The results indicate that a few personnel may experience notable mild eye, nose, or throat irritation; most personnel will experience only mild effects. Pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated (Reference 9, Table 3-10).

For the highest observed $PM_{2.5}$ sample concentration, the hazard severity was critical. During peak exposures at the critical hazard severity level, most if not all personnel will experience very notable eye, nose, and throat irritation and respiratory effects. Visual acuity is impaired, as is overall aerobic capacity. Some personnel will not be able to perform assigned duties. Some lost-duty days are expected. Those with a history of asthma or cardiopulmonary disease will experience more severe symptoms. Conditions may also result in adverse, non-health related materiel/logistical impacts (Reference 9, Table 3-10).

2.4.4 Long-term health risks:

Variable (Low to Moderate): The long-term health risk assessment is Low to Moderate based on average $PM_{2.5}$ concentrations, and the likelihood of exposure at this hazard severity level. A Moderate health risk level suggests that long-term exposure to $PM_{2.5}$ is expected to have limited future medical surveillance activities and related resources anticipated (Reference 9, Table 3-3). Confidence in the long-term $PM_{2.5}$ health risk assessment is low (Reference 9, Table 3-6).

The hazard severity was marginal (>65 $\mu g/m^3$) for average $PM_{2.5}$ sample concentrations. The results suggest that with repeated exposures above the marginal hazard severity threshold, the risk for development of chronic health conditions such as reduced lung function or exacerbated chronic bronchitis, chronic obstructive pulmonary disease (COPD), asthma, atherosclerosis, or other cardiopulmonary diseases could occur in generally healthy troops. Those with a history of asthma or cardiopulmonary disease have a higher risk for developing these chronic conditions (Reference 9, Table 3-11).

2.5 Airborne Metals

2.5.1 Sample data/Notes:

A total of 223 valid ambient and 8 fuel area PM_{10} airborne metal samples were collected at Bagram Air Field from 2002 to 2010.

2.5.2 Short-term health risks:

Low: Cadmium (2005 – 2007) data show low short-term health risk from peak exposure concentration of 0.031 ug/m^3 which exceeds the short term negligible MEG of 0.0205 ug/m^3. Confidence for risk assessments was medium (Reference 9, Table 3-6). Average exposure concentration (0.0058 ug/m^3) was below the short term negligible MEG and was not considered a potential hazard.

2.5.3 Long-term health risks:

Low: Cobalt (2005 – 2007) data show low long-term health risks from average exposure concentration of 0.0.0007 ug/m^3 which exceeded the long term negligible MEG of 5.33 E -7 ug/m^3. Confidence for risk assessments was medium (Reference 9, Table 3-6). Low risk hazards are expected to have little or no impact on mission readiness.

2.6 Volatile Organic Compounds (VOC)

2.6.1 Sample data/Notes:

The health risk assessment is based on average and peak concentration of 11 valid ambient and 8 fuel area volatile organic chemical (VOC) air samples collected from 2002 to 2010, and the likelihood of exposure. None of the analyzed volatile organic chemical (VOC) pollutants was found at concentrations above short-term MEGs, and only acrolein concentration (3.67 ug/m3) exceeded the long-term 1 year negligible MEG (0.137 ug/m3). However, MEGs are not available for all analytes detected and the risk may be underestimated. Additionally, some chemicals were not evaluated. This may also influence the uncertainty in these conclusions.

2.6.2 Short-term health risk:

None identified based on available sampling data. For some analytes (beryllium, cadmium, and vanadium), the analytical limit of quantitation (LOQ) was above the military exposure guidelines, which may cause inaccurate population exposure point concentrations, and as a result, the risk may be underestimated.

2.6.3 Long-term health risk:

Because acrolein was only detected in a single sample on 29 December 2007, a risk assessment for exposure to this chemical was not possible. The average concentration of 3.67 ug/m^3 was calculated from three valid samples (the two non-detect samples used j coded values) and was greater than the 1 year negligible MEG of 0.137 ug/$m^{3.}$

3 Soil

3.1 Site-Specific Sources Identified

3.2 Sample data/Notes:

A total of 23 valid surface soil and 10 valid sub-surface samples were collected from 1 January 2003 to 31 December 2009 to assess OEH health risk to deployed personnel. The primary soil contamination exposure pathways are dermal contact and dust inhalation. Typical parameters analyzed for included semi volatile organic compounds (SVOCs), heavy metals, polychlorinated biphenyls (PCBs), pesticides, herbicides. If the contaminant was known or suspected, other parameters may have been analyzed for (i.e. total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAH) near fuel spills). For the risk assessment, personnel are assumed to remain at this location for 6 months to 1 year.

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. All collected samples were below the 1-year Negligible MEGs, with the exception of a single surface soil sample that was collected from within a former plating facilities building undergoing remediation. This single sample was not considered representative of soil conditions or exposure at Bagram Air Field.

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 Bagram Air Field will be directly exposed to reverse osmosis water purification unit (ROWPU) treated and disinfected fresh bulk water, since this classification of water is primarily used for personal hygiene, showering, cooking, and for use at vehicle wash racks. Untreated water was used for personal hygiene, vehicle and aircraft wash racks and dust suppression only and was considered in this assessment.

4.1 Drinking Water: ROWPU Treated

4.1.1 Site-Specific Sources Identified

Bagram Air Field is surrounded by the Hindu-Kush Mountain Range and the snowmelt from the surrounding mountains recharges the base's aquifer. As of 2009, BAF has four ground water wells, all operated by KBR®. Two of the wells were located at the North water point, one well was located at the West water point, and one was located at the South water point. A review of Sanitary Surveys from 2003 to February 2005 indicates that most camps used reverse osmosis water purification unit (ROWPU) treated bulk water as their primary source of potable drinking water. From February to April 2006, notes contained in field inspections showed that all camps began to switch to bottled water for their primary drinking source.

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 this location were expected to remain at this site for approximately 1 year. A conservative (protective) assumption is that personnel routinely and continuously consumed less than 15L/day for up to 365 days (1-year). It is further assumed that control measures and/or personal protective equipment were not used. Of the 151 treated samples, five were described as ROWPU-treated bulk water drinking samples. The 2004 – 2005 deployment OEH surveillance samples and analytical data for BAF that were reported by the Public Health Command Region Europe (PHCR-Europe) were not included due to database conversion issues.

4.1.3 Short-term health risk:

Low: Boron was detected in 3 of 3 valid samples in 2007. Peak concentration (1.0 mg/L) exceeded the short-term (14-day) 15L/day MEG of 0.93 mg/L and is considered a low short-term health risk hazard. Confidence is low for risk assessment due to lack of sufficient quantity and quality of samples (TG 230 Table 3-6).

4.1.4 Long-term health risk:

Low: Lead in 2003 was detected with a concentration of 0.063 mg/L from a single sample, which exceeded the long-term (1-year) 15L/day MEG of 0.015 mg/L and is considered low risk chronic hazards. Confidence is low for risk assessment due to lack of sufficient quantity and quality of samples (TG 230 Table 3-6).

4.2 Drinking Water: Bottled or Packaged Water

4.2.1 Site-Specific Sources Identified

There were multiple bottled water brands sampled at Bagram Air Field. These samples included Jeema®, Emirates®, Cristal®, Masafi®, Nestle® PureLife, Viva®, Obi-Zulol™, Tanuf®, Aria™, Kinley®, and Oasis® brands of bottled water. It is important to note that water from a given brand may not be produced or bottled at the same source. Some brands of bottled water come packaged with the same bottle label, but could be from multiple bottling plants and locations that use various water sources and treatment methods.

4.2.2 Sample data/Notes:

To assess the potential for adverse health effects to troops, the following assumptions were made about dose and duration: A conservative (protective) assumption was that personnel routinely ingested 15 L/day of bottled water for up to 365 days (1-year). It was further assumed that control measures were not used. A total of 86 valid bottled water samples were collected from 2005 to 2009.

4.2.3 Short-term health risk:

Low: Boron was detected in 8 of 22 valid samples in 2007, and 9 of 10 valid samples in 2008. Peak concentration of Boron in 2007 (1.1 mg/L) and 2008 (1.3 mg/L) exceeded the short-term (14-day) 15L/day MEG of 0.93 mg/L and is considered a low short-term health risk hazard. Confidence for risk assessments was low (TG 230 Table 3-6).

4.2.4 Long-term health risk:

Low: Thallium was detected in 4 of 17 valid samples in 2009. The peak concentration of Thallium (0.01 mg/L) exceeded the long-term (1-year) 15L/day MEG of 0.0003 mg/L and is considered low risk chronic hazards. Confidence for risk assessments was low (TG 230 Table 3-6).

4.3 Non-Drinking Water: ROWPU Treated

4.3.1 Site-Specific Sources Identified

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

4.3.2 Sample data/Notes:

To assess the potential for adverse health effects to troops the following assumptions were made about dose and duration: All U.S. personnel at this location were expected to remain at this site for

approximately 1 year. A conservative (protective) assumption is that personnel routinely consumed less than 5L/day of non-drinking water for up to 365 days (1-year). It is further assumed that control measures and/or personal protective equipment were not used. A total of 27 disinfected bulk water (Non-Drinking) samples from 2003 to 2009 were described as either non-drinking or secondary drinking sources and were evaluated for this health risk assessment. Deployment samples from 2004 and 2005 were sent to PHCR-Europe for analyses, and were not available for this POEMS document. No chemicals were detected at levels above the short or long-term MEGs.

4.3.3 Short and long-term health risks:

None identified based on available sample data. All collected samples were below the short and long-term Negligible MEGs.

4.4 Non-Drinking Water: Untreated

4.4.1 Site-Specific Sources Identified

The BAF is surrounded by the Hindu-Kush Mountain Range and the snowmelt from the surrounding mountains recharges the base's aquifer. As of 2009, BAF has four ground water wells, all operated by KBR®. Two of the wells are located at the North water point, one well is located at the West water point, and one is located at the South water point. 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. None of the untreated water samples were characterized or described as drinking water or a secondary drinking source.

4.4.2 Sample data/Notes:

To assess the potential for adverse health effects to troops the following assumptions were made: All U.S. personnel at this location were expected to remain at this site for approximately 1 year. It is further assumed that control measures and/or personal protective equipment were not used. Of the 151 total samples submitted for BAF, 33 were characterized as untreated samples and were described as water that was used for personal hygiene; vehicle and aircraft wash racks, and dust suppression only. Since untreated water was not being consumed, accidental ingestion of untreated water may have occurred in times of showering or personal hygiene use (e.g. brushing teeth), under which conditions are comparable to a lower, 5L/day ingestion rate, although 5L/day is not typically ingested at such events. Deployment samples from 2004 and 2005 were sent to PHCR-Europe for analyses, and were not available for this POEMS document.

4.4.3 Short and long-term health risk:

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 Environmental Surveillance Library (MESL) from 19 January 2002 through 30 October 2010.

5.2 Depleted Uranium (DU)

No specific hazard sources were documented in the DOEHRS, or MESL from 19 January 2002 through 30 October 2010.

5.3 Ionizing Radiation

Medical and dental radiography are utilized in the expeditionary medical support (EMEDS) Clinic. Radiology personnel are enrolled in the thermoluminescent dosimetry (TLD) program. Permitted radioactive materials and generally licensed devices are used in CBRNE detection equipment, moisture density gauges and targeting pods.

Backscatter x-ray systems for screening personnel and/or vehicles at the installation Entry Control Points (ECPs). Two separate systems are in use, one for pedestrians and one for vehicles.

Rapiscan Secure 1000 is a walk-up system used for screening personnel (pedestrians) entering the base. All non-US personnel entering the installation are screened using the Rapiscan. The AS & EZ-Backscatter systems are mounted in two unmarked, nondescript passenger vans operated at ECP 1. The vans are unoccupied and unattended during operations; SFS personnel review the images from an observation post located approximately 50 yards away. Important note: The rapidscan operation at ECP 1 has been repositioned as of February 2011, and is no longer considered a health risk hazard (Reference 13).

5.3.1 Short -term health risks:

None identified based on the available data.

5.3.2 Long-term health risks:

Low: As currently configured, radiation exposure is insignificant for Z-Backscatter van operators as well as the Rapiscan operators at ECP 3. At ECP 1, Rapiscan operations may potentially expose personnel to radiation levels that approach the general public dose limit over the course of a 6-month deployment. Although no exposure limits were exceeded, the As Low As Reasonably Achievable (ALARA) principle applies. Long-term health risk is considered low. Confidence for risk assessments was low (Reference 9, Table 3-6).

5.4 Non-Ionizing Radiation

No specific hazard sources were documented in the DOEHRS, or MESL from 19 January 2002 through 30 October 2010.

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) 11 (Reference 11) 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 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) to Low (hepatitis E) if local food or water is consumed. Preventive Medicine measures reduced the risk to Low. Confidence in the health risk estimate is high.

6.1.4 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 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

Moderate, mitigated to Low: Potential unmitigated risk to U.S. personnel is Moderate 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.

6.2.9 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.

6.2.10 Long-term health risks:

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

6.3 Water Contact Diseases

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

6.3.1 Leptospirosis

Moderate, mitigated to Low: Human infections occur seasonally (typically April through November) through exposure to water or soil contaminated by infected animals and is associated with wading, and

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

6.3.2 Short-term health risks:

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

6.3.3 Long-term health risks:

None identified based on available data.

6.4 Respiratory Diseases

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

6.4.1 Tuberculosis (TB)

Moderate, mitigated to Low: Potential health risk to U.S. personnel is Moderate, mitigated to Low, year round. Transmission typically requires close and prolonged contact with an active case of pulmonary or laryngeal TB, although it also can occur with more incidental contact. The Army Surgeon General has defined increased risk in deployed Soldiers as indoor exposure to locals or third country nationals of greater than one hour per week in a highly endemic active TB region. Additional mitigation included active case isolation in negative pressure rooms, where available.

6.4.2 Meningococcal meningitis

Low: Meningococcal meningitis poses a Low risk and is transmitted from person to person through droplets of respiratory or throat secretions. Close and prolonged contact facilitates the spread of this disease. Meningococcal meningitis is potentially a very severe disease typically requiring intensive care; fatalities may occur in 5-15% of cases.

6.4.3 Short-term health risks:

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

6.4.4 Long-term health risks:

None identified based on available data. Tuberculosis is evaluated as part of the post deployment health assessment (PDHA). A TB skin test is required post-deployment if potentially exposed and is based upon individual service policies.

6.5 Animal-Contact Diseases

6.5.1 Rabies

Moderate, mitigated to Low: Rabies posed a year-round moderate risk. Occurrence in local animals was well above U.S. levels due to the lack of organized control programs. Dogs are the primary reservoir of rabies in Afghanistan, and a frequent source of human exposure. Rabies is transmitted by exposure to the virus-laden saliva of an infected animal, typically through bites, but could occur from scratches contaminated with the saliva. A U.S. Army Soldier stationed in Afghanistan died of rabies on 31 August 2011 (Reference 12). 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 Animals

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 Bagram Air Base, 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):* Venom effects are mostly minor and even significant envenoming is unlikely to be lethal.

7.2 Scorpions

- *Afghanobuthus naumanni:* Stings by these scorpions are likely to cause only short lived local effects, such as pain, without systemic effects.
- *Androctonus afghan, Androctonus amoreux, and Androctonus baluchicus:* Severe envenoming possible, potentially lethal; venom may produce direct or indirect cardio toxicity.
- *Compsobuthus rugosulus and Compsobuthus tofti:* Severe envenoming possible, potential lethality and systemic effects unknown.
- *Hottentotta alticola, Hottentotta saulcyi:* Moderate envenoming possible but unlikely to prove lethal.
- *Mesobuthus caucasicus, Mesobuthus eupeus and Mesobuthus macmahoni:* Stings by these scorpions are likely to cause only short lived local effects, such as pain, without systemic effects.
- *Orthochirus afghanus, Orthochirus bicolor, Orthochirus jalalabadensis, Orthochirus pallidus, Orthochirus samrchelsis and Orthochirus scrobiculosis:* Severe envenoming possible, potential lethality and systemic effects unknown.

7.3 Snakes

- *Boiga trigonata* (Common Cat Snake), *Hemorrhis ravergieri* (Spotted Whip Snake) and *Telescopus rhinopoma* (Indian Desert Cat Snake): Mild venom: most likely minor local pain and swelling only.

- *Echis multisquamatus* (Central Asian Saw-Scaled Viper), *Echis sochureki* (Sochurek's Saw-Scaled Viper), *Macrovipera lebetina turanica* (Levantine Viper): Severe envenoming possible, potentially lethal; venom has coagulopathic and hemorrhagic effects.
- *Gloydius halys* (Haly's Pit Viper): Severe envenoming possible, potentially lethal; venom has coagulopathic, with secondary renal damage.
- *Naja oxiana* (Oxus cobra): Severe envenoming possible, potentially lethal; venom causes moderate to severe neurotoxic paralysis.

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 9, Table 3-6).

7.5 Long-term health risk:

None identified.

8 Heat/Cold Stress

The Bagram airfield is located at 1,500 m above sea level. Precipitation is concentrated in the winter (snow) and spring months. Summers are long and hot (temperatures range from 70 – 91 degrees Fahrenheit (°F)) but have very low humidity. Fall (October and November) is warm and dry. Winters are cold but short, lasting from December to March (temperature range: 19 - 50 °F). Spring in Bagram starts in late March and is the wettest time of the year.

8.1 Heat

Summer (June - September) monthly mean daily maximum temperatures range from 74 °F to 84 °F with an average temperature of 80 °F based on historical climatological data from the U.S. Air Force Combat Climatology Center, 14th Weather Squadron. The health risk of heat stress/injury based on monthly average temperatures alone is Low (< 78 °F) from September – May, Moderate (78-81.9°F) for June and high (82-87.9°F) from July to August. However, work intensity and clothing/equipment worn pose greater health risk of heat stress/injury than environmental factors alone (Reference 6). 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: Risk of heat injury in unacclimatized or susceptible populations (older, previous history of heat injury, poor physical condition, underlying medical/health conditions), and those under operational constraints (equipment, PPE, vehicles) is High from July - August, Moderate in June, and Low from September - May. The risk of heat injury is reducible to low through preventive measures such as work/rest cycles, proper hydration and nutrition, and monitoring WBGT. Confidence in the health risk estimate is low (Reference 9, 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 9, Table 3-6).

8.2 Cold

8.2.1 Short-term health risks:

Winter (December - March) mean daily minimum temperatures range from 34 °F to 53 °F with an average temperature of 41 °F based on historical climatological data from the U.S. Air Force Combat Climatology Center, 14th Weather Squadron. Because even on warm days a significant drop in temperature after sunset by as much as 40 °F can occur, there is a risk of cold stress/injury from December - March. The risk assessment for Non-Freezing Cold Injuries (NFCI), such as chilblain, trench foot, and hypothermia, is Low based on historical temperature and precipitation data. Frostbite is unlikely to occur because temperatures rarely drop below freezing. However, personnel may encounter significantly lower temperatures during field operations at higher altitudes. As with heat stress/injuries, cold stress/injuries are largely dependent on operational and individual factors instead of environmental factors alone.

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

8.1.2 Long-term health risk:

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

9 Noise

9.1 Continuous

Aircraft operations have the potential to cause significant noise hazard to flight line support personnel. Especially during intermediate and full power runs of fixed wing aircraft (e.g. F-15 and F-16 engine test). Because of the potential noise hazard inherent in flight line operations, personnel are required to wear dual hearing protection when working on the flight line and are enrolled in the Hearing Conservation Program. Personal noise dosimetry was performed on 3 November 2010 to measure ground technician exposure during engine run-ups. Most sustained engine run events were identified below 110 dBA, which do not present a significant hazard when double hearing protection is worn. For example, the effective noise reduction rate (NRR) of 22 dBA, when double hearing protection is worn, will reduce 110 dBA to 88 dBA which has a 4 hour exposure limit per day). Extreme noise events during engine runs (intermediate and full-power runs) produced sustained dBA of 123.6 (14 minute exposure) and 135.1 dBA (32 minute exposure) and may have exceeded the dosimeter upper measurement limit of 140 dBA. Existing control (double hearing protection) is inadequate to fully protect personnel against noise hazard during these extreme events (Air Force Occupational Safety and Health Standard 2006).

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

9.1.1 Short-term health risk:

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 9, Table 3-6).

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 9, Table 3-6).

9.2 Impulse

No specific hazard sources were documented in the DOEHRS or MESL from 19 January 2002 through 30 October 2010.

9.2.1 Short-term and Long-term health risks:

Not evaluated.

10 Unique Incidents/Concerns

10.1 Potential environmental contamination sources

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

10.2 Waste Sites/Waste Disposal

No specific hazard sources were documented in the DOEHRS or MESL from 19 January 2002 through 30 October 2010.

10.3 Fuel/petroleum products/industrial chemical spills

No specific hazard sources were documented in the DOEHRS or MESL from 19 January 2002 through 30 October 2010.

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. Several pesticide application reports in the MESL data portal for Bagram Air Field (October 2001 to December 2009) list the usage of pesticides on the site. For each pesticide product applied during this period, the EPA approved label has been archived, providing a framework how each pesticide handled and applied (see below).

10.4.1 Rodenticides

Bromadialone, brodifacoum, bromethalin, diphacinone, and zinc phosphide were used year round to control rodents.

10.4.2 Insecticides

Hydramethylnon, nithiazine, fipronil, imidacloprid, d-trans allethrin, phenothrin, methomyl, beta-cyfluthrin, deltamethrin, and permethrin were used from spring through fall to control ants, wasps, hornets, bees and filth flies.

Hydramethylnon, pyrethrins, piperonyl butoxide, MGK-264, deltamethrin, (S)-methoprene, Bacillus thuringiensis var. israelensis, beta-cyfluthrin, and fipronil were used 3-4 times/year to control mosquitoes, spiders, cockroaches.

Deltamethrin, pyrethrins, beta-cyfluthrin, lambda-cyhalothrin, piperonyl butoxide, MGK-264 , hydramethylnon, fipronil, (S)-hydroprene, and bifenthrin were used 1-2 times/year to control camel spiders, termites, scorpions, bed bugs, mites, crickets, ticks, fleas, pantry pests, silverfish, and birds.
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 9, Table 3-6).

10.5 Asbestos

Asbestos containing materials (ACM) are common in east Europe, Indian subcontinent, and Asia because it is a very good thermal insulator, fire retardant and binder in friction products, and they are inexpensive to make. If the is not friable then the asbestos does not present a significant hazard. However without proper controls, ACM does present an elevated risk to soldiers if it is in poor condition, friable, or if the material is disturbed, such as in maintenance operation or renovation and demolitions. Asbestos can also present a risk to the GI track if it is ingested.

Heating vat liners in Bldg 365 contained 20% asbestos and are considered ACM. These rooms are sealed off and only PM personnel are authorized to break the seal and enter. Asbestos was also found

in material piles in the vicinity of bldg 820 on 26 August 2003.

10.5.1 Short-term health risk:

None identified.

10.5.2 Long-term health risk:

Low: Long term health risk from asbestos exposure is low. Confidence in risk assessment is low (Reference 9, Table 3-6).

10.6 Lead Based Paint

No specific hazard sources were documented in the DOEHRS or MESL from 19 January 2002 through 30 October 2010.

10.7 Burn Pit

The burn pit and burn boxes are located within the same solid waste yard situated at the northeast periphery of Bagram Air Field. Northeasterly winds may increase population exposure of emissions from waste burning. These wind directions occur at frequencies greater than 33% from May through August with the highest frequencies (41%) occurring in July.

While not specific to Bagram Air Field, 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.

10.7.1 *Particulate matter, 10 microns* (PM_{10})

Sample data/Notes:

Exposure Guidelines:
Short Term (24-hour) PM_{10} (µg/m3): Negligible MEG=250, Marginal MEG=420, Critical MEG=600, Long-term PM_{10} MEG (µg/m3): Not Available.

The risk assessment was based on 31 samples taken near the burn pit from 2004, 2009 and 2010. The range of 24-hour PM_{10} concentrations was 39 to 1002 µg/m^3 with an average concentration of 368 µg/m^3.

10.7.1.1 Short-term health risk:

Variable (Low to High): Results of data analyses show low short-term health risks for typical exposures, and high short-term health risks for peak exposures. For 37% of the time during this period the PM_{10} daily risk levels indicated there was no hazard. Other daily risk levels observed during this time were low (33%), moderate (13%) and high (17%). Confidence in risk assessment is low to medium (TG 230 Table 3-6). Elevated daily risk levels (moderate to high) possibly associated with acute health effects occurred 30% of the time. A small percentage of personnel may experience notable eye, nose, and throat irritation; most personnel will experience only mild effects. Pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.

10.7.1.2 Long-term health risk:

Not Evaluated-no available health guidelines. The EPA has retracted its long-term standard (NAAQS) for PM_{10} due to an inability to clearly link chronic health effects with chronic PM_{10} exposure levels.

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

Sample data/Notes:

Exposure Guidelines:
Short-term (24-hour) $PM_{2.5}$ MEGs (µg/m3): Negligible MEG=65, Marginal MEG=250, Critical MEG=500;
Long-term $PM_{2.5}$ MEGs (µg/m3): Negligible MEG=15, Marginal MEG=65.

The risk assessment is based on 20 samples taken near the burn pit from 2009 and 2010. The range of 24-hour $PM_{2.5}$ concentrations in these samples was 19 to 350 µg/m^3 with an average concentration of 150 µg/m^3.

10.7.2.1 Short-term health risk:

Variable (Low to Moderate): Results of data analyses show low to moderate short-term health risks for typical exposures and moderate for peak exposures. For 28% of the time during this period, $PM_{2.5}$ levels indicated there was no hazard. Other risk levels observed during this time were low (67%) and moderate (1%).Confidence in risk assessment is low to medium (TG 230 Table 3-6). Elevated daily risk levels (moderate) that may have been associated with transient acute health effects occurred 1% of the time. A small percentage of personnel may experience notable eye, nose, and throat irritation; most personnel will experience only mild effects. Pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.

10.7.2.1 Long-term health risk:

Moderate: Results of data show there was a moderate long-term risk levels associated with $PM_{2.5}$ concentrations. Confidence was medium for risk assessments (TG 230 Table 3-6). Long-term exposure at $PM_{2.5}$ concentration above 65 mg/m^3 may increase the risk for developing chronic health conditions such as reduced lung function or exacerbated chronic bronchitis, chronic obstructive pulmonary disease (COPD), asthma, atherosclerosis, or other cardiopulmonary diseases. Those with a history of asthma or cardiopulmonary disease are considered to be at particular risk.

10.7.3 Airborne Metals (PM_{10})

Sample data/Notes:

Degree of risk is estimated based on comparison of metals results from 25 total air samples to specified MEGs. Samples were taken from 2004, 2009 and 2010. None of the analyzed metals in the samples were found at concentrations above a short- or long-term MEG during the pre-screen.

10.4.3.1Short and Long-term health risk:

None identified based on available data.

10.7.4 Volatile Organic Compounds (VOC)

10.7.4.1 Sample data/Notes:

The risk assessment was performed using 19 burn pit related samples from 2010. None of the analyzed volatile organic chemical (VOC) pollutants was found at concentrations above short-term MEGs. However, MEGs are not available for all analytes detected so the risk may be underestimated. Additionally, some chemicals were not evaluated. This may also influence the uncertainty in these conclusions.

10.7.4.2 Short-term health risk:

None identified based on available sampling data.

10.7.4.3 Long-term health risk:

None identified based on available sampling data.

10.8 Bagram Theater Internment Facility (BTIF)

The Bagram Theater Internment Facility (BTIF) is a United States detention facility constructed in 2002 at BAF. It was formerly known as the Bagram Collection Point. The facility initially used (from 2002 to late 2009) for the BTIF was an old Soviet warehouse/hangar. In addition to housing prisoners some areas of the warehouse were constructed and used as administration areas and offices for US personnel supporting the facility. Exposure concerns resulting from the conditions of the old warehouse resulted in several years (2004-2008) of environmental and occupational sampling within the facility to assess potential health risk to personnel working in the facility. All identified contaminants were evaluated and determined to present low risk. Preventive medicine personnel summarized this information for inclusion in the medical records of personnel working at the facility. After September 2009, prisoners were transferred to a newly constructed facility. Although the new facility is near the previous facility, DoD sources sometimes refer to it as the Detention Facility In Parwan (DFIP) though some also refer to the new facility as BTIF.

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.

13. USA TF44-MED. 12 May 2011. MEMORANDUM FOR USCENTCOM CCSG-AA. Subject: Radiation Hazard Evaluation, Bagram Air Field Pedestrian Screening System Entry Control Point 1, 11 May 2011.

[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.

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