Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Victory Base Complex (VBC) and vicinity, Iraq
Calendar Years: (2003 to 2011)

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) 0017-12 (References 1-3).

PURPOSE: This POEMS documents the Department of Defense (DoD) assessment of occupational and environmental health (OEH) risk for VBC and vicinity that includes Area Four, Baghdad International Airport (BIAP), Camp Brooklyn, Joint Security Station (JSS) Constitution, Camp Cropper, Forward Operating Base (FOB) Hawk, Camp Liberty, Radwaniya Palace Complex (RPC), Camp Sather (also known as Sather Air Base), Logistics Base (LB) Seitz, Camp Slayer, Camp Steeler, Camp Striker (also known as Camp Stryker), and Camp Victory. It presents a qualitative summary of health risks identified at VBC and vicinity and their potential medical implications. The report is based on information collected from 17 May 2003 through 17 October 2011 to include deployment OEH surveillance sampling and monitoring data (e.g., air, water, and soil), field investigation and health assessment reports, as well as country and area-specific information on endemic diseases.

This assessment assumes that environmental sampling at VBC and vicinity during this period was performed at representative exposure points selected to characterize health risks at the population–level. Due to the nature of environmental sampling, the data upon which this report is based may not be fully representative of all the fluctuations in environmental quality or capture unique occurrences. While one might expect health risks pertaining to historic or future conditions at this site to be similar to those described in this report, the health risk assessment is limited to 17 May 2003 through 17 October 2011.

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

SITE DESCRIPTION: VBC is a large complex comprised of several camps all generally within the same outer perimeter. The complex includes Camp Victory, Camp Liberty, Camp Slayer, LB Seitz, Camp Striker, RPC, Camp Sather, Camp Brooklyn, JSS Constitution, Camp Cropper, FOB Hawk, Camp Steeler, Area Four, and BIAP. VBC is located west of the city of Baghdad. This site was the former location of several Iraqi presidential palaces and the Baghdad International Airport (BIAP). The other areas not occupied include agricultural farmlands that surrounded the presidential palaces, a former recreational ground and an Iraqi missile school. The former palaces, surrounding buildings and warehouses make up the majority of existing structures on the VBC. These existing structures are used as administrative offices; morale, welfare, and recreation (MWR) facilities; Army and Air Force Exchange Service (AAFES) post exchange (PX) facilities; living areas; flight operations, logistical support, vehicle repair facilities, warehousing and parking for the multi-National Forces-Iraq, the Multi-National Corps-Iraq, and subordinate units. The VBC is situated on a flood plain of the Tigris River with soils predominantly made up of fine quaternary silts comprised mostly of calcite with a small presence of gypsum. These soils have increasingly become more salient and unconsolidated due to over farming thus making them more prone to erosion from both wind and water. The roads on VBC are a mixture of paved, graveled and dirt roadways. During the dry season, unimproved roads can be a

source of suspended particulate matter. The surrounding areas to the north and east of VBC are residential and urban regions. Areas to the south and west are primarily agricultural fields.

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

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

Short-term health risks & medical implications:

The following hazards may be associated with potential acute health effects in some personnel during deployment at VBC and vicinity:

Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}) from environmental dust and burn pits and/or incinerators, food/waterborne diseases (e.g., bacterial diarrhea, hepatitis A, typhoid/paratyphoid fever, diarrhea-cholera, diarrhea-protozoal, brucellosis, hepatitis E); other endemic diseases (cutaneous leishmaniasis (acute), Crimean-Congo hemorrhagic fever, sandfly fever, scrub typhus(mite-borne), leptospirosis, schistosomiasis, Tuberculosis (TB), rabies, Q fever); and heat stress. For food/waterborne diseases (e.g., bacterial diarrhea, hepatitis A, typhoid/paratyphoid fever, diarrhea-cholera, diarrhea-protozoal, brucellosis, hepatitis E), if ingesting local food and water, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (hepatitis A, typhoid/paratyphoid fever, brucellosis, hepatitis E). Risks from food/waterborne diseases may have been reduced with preventive medicine controls and mitigation, which includes hepatitis A and typhoid fever vaccinations and only drinking from approved water sources in accordance with standing CENTCOM policy. For other vector-borne endemic diseases (cutaneous leishmaniasis (acute), Crimean-Congo hemorrhagic fever, sandfly fever, scrub typhus (mite-borne), these diseases may constitute a significant risk due to exposure to biting vectors; risk reduced to 'Low' by proper wear of the treated uniform, application of repellent to exposed skin, bed net use, and appropriate chemoprophylaxis, as well as minimizing areas of standing water and other vector-breeding areas. For water contact diseases (leptospirosis and schistosomiasis) activities involving extensive contact with surface water increase risk. For respiratory diseases (TB), personnel in close-quarter conditions could have been at risk for person-to-person spread. Animal contact diseases (rabies, Q fever), pose year-round risk. For heat stress, risk can be greater during months of April through October, and greater for susceptible persons including those older than 45, of low fitness level, unacclimatized, or with underlying medical conditions, and those under operational constraints (equipment, PPE, vehicles). Risks from heat stress may have been reduced with preventive medicine controls, work-rest cycles, proper hydration and nutrition, and mitigation.

Lithium Battery Warehouse Fire: A week-long fire took place at a lithium battery warehouse near Camp Brooklyn in 2009. See Section 10.8, and Table 2 below, under unique incidents/concerns. Personnel outside of the hazard zone may have experienced mild irritation of the eyes or respiratory tract for a short-term duration and such exposures were not likely severe enough to pose a chronic, long-term health hazard. However individuals affected by exposure to the emissions were not identified (Ref 31).

Air quality: For inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}) from environmental dust, the PM_{10} overall short-term health risk was 'Variable (Low to High).' For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) from environmental dust, the $PM_{2.5}$ overall short-term health risk was 'Low.' However, the entire VBC and vicinity area is an arid and dust-prone desert environment, also subject to vehicle traffic. Consequently, exposures to PM_{10} and $PM_{2.5}$ may vary, as conditions may vary, and may result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel while at this site, particularly exposures to high levels of dust such as during high winds or dust storms. For PM_{10} and $PM_{2.5}$, certain subgroups of the deployed forces (e.g., those with pre-existing asthma/cardio-pulmonary conditions) are at greatest risk of developing notable health effects. Burn pits and/or incinerators were reported in operation at VBC and vicinity – see Section 10.7. The PM_{10} overall short-term health risks specifically for burn pits and/or incinerators was 'Variable (Low to High).' There were insufficient data (too few $PM_{2.5}$ air samples) with which to characterize short-term health risk from exposure to $PM_{2.5}$ near burn pits and/or incinerators. Where burn pits and incinerators exist, all exposures may vary, and exposures to high levels of PM_{10} and $PM_{2.5}$ from smoke may result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups. Although most short-term health effects from exposure to particulate matter and burn pit smoke should have resolved post-deployment, providers should be prepared to consider the relationship between deployment exposures and current complaints. Some individuals may have sought treatment for acute respiratory irritation during their time at Wright and vicinity. Personnel who reported with symptoms or required treatment while at site(s) with burn pit activity should have exposure and treatment noted in medical record (e.g., electronic medical record and/or on a Standard Form (SF) 600

(*Chronological Record of Medical Care*).

Long-term health risks & medical implications:

The following hazards may be associated with potential chronic health effects in some personnel during deployment at VBC and vicinity:

Lithium Battery Warehouse Fire: A week-long fire took place at a lithium battery warehouse near Camp Brooklyn in 2009. See Section 10.8, and Table 2 below, under unique incidents/concerns. Personnel outside of the hazard zone may have experienced mild irritation of the eyes or respiratory tract for a short-term duration and such exposures were not likely severe enough to pose a chronic, long-term health hazard. However, individuals affected by exposure to the emissions were not identified (Ref 31).

Air quality: For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) from environmental dust, the overall long-term health risk was 'Moderate.' Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}) from environmental dust was not evaluated for long-term health risk due to no available health guidelines. However, the entire VBC and vicinity area is an arid and dust-prone desert environment, also subject to vehicle traffic, and conditions may have varied. Burn pits and/or incinerators were reported in operation at VBC and vicinity – see Section 10.7. There were insufficient data (too few $PM_{2.5}$ air samples) with which to characterize long-term health risk from exposure to $PM_{2.5}$ near burn pits and/or incinerators. The PM_{10} and the $PM_{2.5}$ overall long-term health risks were not evaluated at the burn pit and/or incinerator locations at VBC and vicinity due to 'insufficient data (too few $PM_{2.5}$ air samples) collected near burn pits (or incinerators) provided for analysis' and due to 'no available health guidelines for PM_{10}' - see Section 10.7. However, burn pit and incinerator exposures all may vary, as conditions may have varied. For inhalational exposure to high levels of dust containing PM_{10} and $PM_{2.5}$, such as during high winds or dust storms, and for exposures to burn pit smoke, it is considered possible that some otherwise healthy personnel, who were exposed for a long-term period to dust and particulate matter, could develop certain health conditions (e.g., reduced lung function, cardiopulmonary disease). Personnel with a history of asthma or cardiopulmonary disease could potentially be more likely to develop such chronic health conditions. While the dust and particulate matter exposures and exposures to burn pits are acknowledged, at this time there were no specific recommended, post-deployment medical surveillance evaluations or treatments. Providers should still consider overall individual health status (e.g., any underlying conditions/susceptibilities) and any potential unique individual exposures (such as burn pits/barrels, incinerators, occupational or specific personal dosimeter data) when assessing individual concerns. Certain individuals may need to be followed/evaluated for specific occupational exposures/injuries (e.g., annual audiograms as part of the medical surveillance for those enrolled in the Hearing Conservation Program; and personnel covered by Respiratory Protection Program and/or Hazardous Waste/Emergency Responders Medical Surveillance).

Table 2. Population-Based Health Risk Estimates - VBC and vicinity that includes Area Four, BIAP, Camp Brooklyn, JSS Constitution, Camp Cropper, FOB Hawk, Camp Liberty, RPC, Camp Sather (also known as Sather Air Base), LB Seitz, Camp Slayer, Camp Steeler, Camp Striker (also known as Camp Stryker), and Camp Victory[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: Variable (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: Variable (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. A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: Low. A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.
	Long-term: Moderate. A small percentage of personnel may be at increased risk for developing chronic conditions, particularly those more susceptible to acute effects (e.g., those with asthma/existing respiratory diseases).		Long-term: Moderate. A small percentage of personnel may be at increased risk for developing chronic conditions, particularly those more susceptible to acute effects (e.g., those with asthma/existing respiratory diseases).
PM_{10} Metals	Short-term: Low for PM_{10} cadmium in 2004, PM_{10} lead in 2005, and PM_{10} vanadium in 2006.		Short-term: Low for PM_{10} cadmium in 2004, PM_{10} lead in 2005, and PM_{10} vanadium in 2006.
	Long-term: Low for PM_{10} aluminum and vanadium in 2006. Moderate for PM_{10} cobalt in 2006.		Long-term: Low for PM_{10} aluminum and vanadium in 2006. Moderate for PM_{10} cobalt in 2006.
$PM_{2.5}$ Metals	Short-term: **Error! Reference source not found.**		Short-term: **Error! Reference source not found.**
	Long-term: **Error! Reference source not found.**		Long-term: **Error! Reference source not found.**
Water			
Water for Other Purposes	Short-term: None to None to Low.	Water treated in accordance with standards applicable to its intended use	Short-term: None to None to Low.
	Long-term: None identified based on available sample data.		Long-term: None identified based on available sample data.
ENDEMIC DISEASE			
Food borne/Waterborne (e.g., diarrhea-bacteriological)	Short-term: Variable, High (bacterial diarrhea, hepatitis A, typhoid fever) to Moderate (diarrhea-cholera, diarrhea-protozoal, brucellosis and hepatitis E). If local food/water were consumed, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (Hepatitis A, Typhoid fever, Brucellosis, Hepatitis E).	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

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
Arthropod Vector Borne	Short-term: Variable, Moderate for leishmaniasis-cutaneous, Crimean-Congo hemorrhagic fever, sandfly fever and typhus-miteborne; Low for West Nile fever, and Plague.	Preventive measures include proper wear of treated uniform, application of repellent to exposed skin, and bed net use, minimizing areas of standing water.	Short-term: Low
	Long-term: Low (Leishmaniasis-visceral infection)		Long-term: No data available
Water-Contact (e.g., wading, swimming)	Short-term: Moderate for leptospirosis and schistosomiasis.	Prohibiting recreational water activities and water contact avoidance.	Short-term: Low for leptospirosis and schistosomiasis.
	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 and Q-fever, and Low for Anthrax and 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., *Scorpio maurus*) to potentially lethal effects (e.g., *Vipera albicornuta*).	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., *Scorpio maurus*) to potentially lethal effects (e.g., *Vipera albicornuta*).
	Long-term: No data available		Long-term: No data available
HEAT/COLD STRESS			
Heat	Short-term: Low to High, Risk of heat injury is Extremely High from May – October, High in April, and Low from November – March.	Work-rest cycles, proper hydration and nutrition, and Wet Bulb Globe Temperature (WBGT) monitoring.	Short-term: Low to High, mitigated to Low. Risk of heat injury in unacclimatized or susceptible personnel is Extremely High from May – October, High in April, and Low from November – March.
	Long-term: Low. However, the risk may be greater to certain susceptible persons–those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.		Long-term: Low. 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.

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
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.
Unique Incidents/ Concerns			
Lithium Battery Warehouse Fire	A week-long fire took place at a lithium battery warehouse near Camp Brooklyn in 2009. See Section 10.8. Air sampling results indicated that sulfur dioxide did not appear to substantially impact the overall air quality of Camp Brooklyn or VBC but was a potential acute hazard concern. First responder personnel wore self-contained breathing apparatuses and were not exposed to sulfur dioxide emissions. Personnel outside of the hazard zone may have experienced mild irritation of the eyes or respiratory tract for a short-term duration and such exposures were not likely severe enough to pose a chronic, long-term health hazard. However, individuals affected by exposure to the emissions were not identified (Reference 31).		A week-long fire took place at a lithium battery warehouse near Camp Brooklyn in 2009. See Section 10.8. Air sampling results indicated that sulfur dioxide did not appear to substantially impact the overall air quality of Camp Brooklyn or VBC but was a potential acute hazard concern. First responder personnel wore self-contained breathing apparatuses and were not exposed to sulfur dioxide emissions. Personnel outside of the hazard zone may have experienced mild irritation of the eyes or respiratory tract for a short-term duration and such exposures were not likely severe enough to pose a chronic, long-term health hazard. However individuals affected by exposure to the emissions were not identified (Reference 31).

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
Burn Pits	Short-term: PM_{10}: Variable (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). PM_{10} Lead: Low for PM_{10} Lead in 2005. $PM_{2.5}$: Burn pits and incinerators were reported in operation at VBC and vicinity. For VBC and vicinity, the $PM_{2.5}$ overall short-term health risks specifically for burn pits and incinerators were not evaluated due to 'insufficient environmental samples collected near burn pits (or incinerators) provided for analysis'– see Section 10.7. Exposure to burn pit (or incinerator) smoke is variable. Exposure to high levels of PM_{10} and $PM_{2.5}$ from smoke may result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups.	Risks reduced by limiting strenuous physical activities when air quality was especially poor; and action such as closing tent flaps, windows, and doors. Other control measures included locating burn pits downwind of prevailing winds, increased distance from troop populations, and improved waste segregation and management techniques.	Short-term: PM_{10}: Variable (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). PM_{10} Lead: Low for PM_{10} Lead in 2005. $PM_{2.5}$: Burn pits and incinerators were reported in operation at VBC and vicinity. For VBC and vicinity, the $PM_{2.5}$ overall short-term health risks specifically for burn pits and incinerators were not evaluated due to 'insufficient environmental samples collected near burn pits (or incinerators) provided for analysis'– see Section 10.7. Exposure to burn pit (or incinerator) smoke is variable. Exposure to high levels of PM_{10} and $PM_{2.5}$ from smoke may result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups.
	Long-term: PM_{10} and $PM_{2.5}$: Burn pits and incinerators were reported in operation at VBC and vicinity. The PM_{10} and the $PM_{2.5}$ overall long-term health risks were not evaluated at the burn pits and incinerator locations at VBC and vicinity due to 'insufficient environmental samples of $PM_{2.5}$ collected near burn pits (or incinerators) provided for analysis' and due to no available health guidelines for PM_{10} – see Section 10.7. Exposure to burn pit (and incinerator) smoke is variable. Exposure to high levels of PM_{10} and $PM_{2.5}$ in the smoke may be associated with some otherwise healthy personnel, who were exposed for a long-term period, possibly developing certain health conditions (e.g., reduced lung function, cardiopulmonary disease). Personnel		Long-term: PM_{10} and $PM_{2.5}$: Burn pits and incinerators were reported in operation at VBC and vicinity. The PM_{10} and the $PM_{2.5}$ overall long-term health risks were not evaluated at the burn pits and incinerator locations at VBC and vicinity due to 'insufficient environmental samples of $PM_{2.5}$ collected near burn pits (or incinerators) provided for analysis' and due to no available health guidelines for PM_{10} – see Section 10.7. Exposure to burn pit (and incinerator) smoke is variable. Exposure to high levels of PM_{10} and $PM_{2.5}$ in the smoke may be associated with some otherwise healthy personnel, who were exposed for a long-term period, possibly developing certain health conditions (e.g., reduced lung function, cardiopulmonary disease). Personnel

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
	with a history of asthma or cardiopulmonary disease could potentially be more likely to develop such chronic health conditions.		with a history of asthma or cardiopulmonary disease could potentially be more likely to develop such chronic health conditions.

[1]This Summary Table provides a qualitative estimate of population-based short- and long-term health risks associated with the occupational and environment conditions at VBC and vicinity that includes Area Four, BIAP, Camp Brooklyn, JSS Constitution, Camp Cropper, FOB Hawk, Camp Liberty, RPC, Camp Sather (also known as Sather Air Base), LB Seitz, Camp Slayer, Camp Steeler, Camp Striker (also known as Camp Stryker), and Camp Victory. 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 17 May 2003 through 17 October 2011. 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 VBC and vicinity. The health risks are presented as Low, Moderate, High or Extremely High for both acute and chronic health effects. The health risk level is based on an assessment of both the potential severity of the health effects that could be caused and probability of the exposure that would produce such health effects. Details can be obtained from the Army Public Health Center. 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 VBC and vicinity, Iraq by Source

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

2 Air

2.1 Site-Specific Sources Identified

VBC and vicinity is situated in a dusty semi-arid desert environment. Inhalational exposure to high levels of dust and particulate matter, such as during high winds or dust storms, may result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel. Additionally, certain subgroups of the deployed forces (e.g., those with pre-existing asthma/cardio pulmonary conditions) are at greatest risk of developing notable health effects. All personnel were assumed to be exposed to emissions from burn pits and incinerators located in the vicinity of VBC. Therefore, air samples associated with a burn pit or incinerator at VBC and vicinity were included in the following assessment of the air at VBC and vicinity.

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, 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 than 10 micrometers (PM_{10})

2.3.1 Exposure Guidelines:

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

- Negligible MEG = 250
- Marginal MEG = 420
- Critical MEG = 600

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

- Not defined and not available.

2.3.2 Sample data/Notes:

A total of 335 valid PM_{10} air samples were collected from 2003–2011. The range of 24-hour PM_{10} concentrations was 27 $\mu g/m^3$ – 948 $\mu g/m^3$ with an average concentration of 266 $\mu g/m^3$.

2.3.3 Short-term health risks:

Variable (Low to High). The short-term PM_{10} health risk assessment is variable (Low to High) based on average and peak PM_{10} sample concentrations, and the likelihood of exposure at these hazard severity levels. The variable risk is due to significant fluctuation in daily concentrations. Risk from peak exposures was high in 2004, 2005, 2006, and 2007 and moderate in 2003. Risk from average exposures was low in 2003, 2004, 2005, 2006, and 2007. There were not enough samples taken in 2008, 2009, 2010, and 2011 to assess the health risk. A low health risk suggests little or no impact on accomplishing the mission. A moderate health risk suggests a degraded mission capabilities expected with limited in theater medical countermeasures and resources anticipated. A high health risk suggests a 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 standard if hazards occur during the mission (Reference 4, Table 3-2). Daily average health risk levels for PM_{10} show no hazard for 65%, low health risk for 32%, moderate health risk for 7%, and high health risk for 5% of the time. Confidence in the short-term PM_{10} health risk assessment is medium (Reference 4, Table 3-6).

The hazard severity for average PM_{10} concentrations in samples was negligible. The hazard severity was negligible in 2003, 2004, 2005, 2006, and 2007. The results indicate that for negligible hazard severity 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 4, Table 3-11).

For the highest observed PM_{10} sample concentration, the hazard severity was marginal through critical. The hazard severity was marginal in 2003 and was critical in 2004, 2005, 2006, and 2007. During a marginal hazard severity a majority of personnel will experience notable eye, nose, and throat irritation and some respiratory effects. Some lost-duty days are expected. Significant aerobic activity will increase risk. Those with a history of asthma or cardiopulmonary disease are expected to experience increased symptoms. During peak exposures at the critical hazard severity level, most if not all personnel experience 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. 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 4, Table 3-11).

2.3.4 Long-term health risk:

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

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

2.4.1 Exposure Guidelines:

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

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

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

- Negligible MEG = 15
- Marginal MEG = 65.

2.4.2 Sample data/Notes:

A total of 129 valid $PM_{2.5}$ air samples were collected from 2005–2011, no $PM_{2.5}$ air samples were taken prior to 2005. The range of 24-hour $PM_{2.5}$ concentrations was 5 $\mu g/m^3$ – 228 $\mu g/m^3$ with an average concentration of 97 $\mu g/m^3$.

2.4.3 Short-term health risks:

Low. The short-term $PM_{2.5}$ health risk assessment for peak and average sample concentrations is low for 2006, 2009, 2010, and 2011. There were not enough samples taken in 2005, 2007, and 2008 to assess the health risk. A low health risk suggests little or no impact on accomplishing the mission (Reference 4, Table 3-2). Daily average health risk levels for $PM_{2.5}$ show no hazard for 32% and low health risk for 68% of the time. Confidence in the short-term $PM_{2.5}$ health risk assessment was medium (Reference 4, Table 3-6).

The hazard severity was negligible for average and peak $PM_{2.5}$ sample concentrations. The results indicate that for a negligible hazard severity 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 4, Table 3-11).

2.4.4 Long-term health risks:

Moderate. The long-term health risk assessment is moderate for 2006, 2009, 2010, and 2011 based on average $PM_{2.5}$ concentration, and the likelihood of exposure at this hazard severity level. A moderate health risk suggests a degraded mission capabilities in terms of the required mission standard and in reduced mission capability if hazards occurred during the mission (Reference 4, Table 3-3). Confidence in the long-term $PM_{2.5}$ health risk assessment is medium (Reference 4, Table 3-6).

The hazard severity was marginal for average $PM_{2.5}$ sample concentrations. The results predict that with repeated exposures above the marginal hazard severity threshold, it is plausible that development of chronic health conditions such as reduced lung function, exacerbated chronic bronchitis, chronic obstructive pulmonary disease (COPD), asthma, atherosclerosis, or other cardiopulmonary diseases could occur in generally healthy troops. Those with a history of asthma or cardiopulmonary disease are considered to be at particular risk (Reference 4, Table 3-12).

2.5 Airborne Metals

2.5.1 Airborne Metals from PM_{10}

2.5.1.1 Sample data/Notes:

A total of 463 valid PM_{10} airborne metal samples were collected at VBC and vicinity from 2003 to 2011. PM_{10} cadmium was above acute MEGs in 2004, PM_{10} lead was above acute MEGs in 2005, PM_{10} vanadium was above acute MEGs in 2006. PM_{10} aluminum and PM_{10} cobalt were above chronic MEGs in 2006.

2.5.1.2 Short-term health risks:

Low. The short-term health risk assessment for peak and average sample concentrations for PM_{10} cadmium in 2004, PM_{10} lead in 2005, and PM_{10} vanadium in 2006 was low. A low health risk suggests

little or no impact on accomplishing the mission (Reference 4, Table 3-2). Confidence in the short-term PM_{10} metals health risk assessment was medium (Reference 4, Table 3-6).

The hazard severity was negligible for average and peak PM_{10} cadmium, lead, and vanadium sample concentrations. The results indicate that for a negligible hazard severity few exposed personnel (if any) are expected to have noticeable health effects during mission. Exposed personnel are expected to be able to effectively perform all critical tasks during mission operations. Minimal to no degradation of abilities to conduct complex tasks are expected (Reference 4, Table 3-4).

2.5.1.3 Long-term health risks:

Low. The long-term health risk assessment for sample concentrations for PM_{10} aluminum and vanadium in 2006 was low. A low health risk suggests little or no impact on accomplishing the mission (Reference 4, Table 3-2). Confidence in the long-term PM_{10} metals health risk assessment was medium (Reference 4, Table 3-6).

The hazard severity was negligible for average PM_{10} aluminum and vanadium sample concentrations. The results indicate that for a negligible hazard severity few exposed personnel (if any) are expected to develop delayed onset, irreversible effects (Reference 4, Table 3-4).

Moderate. The long-term health risk assessment for sample concentrations for PM_{10} cobalt in 2006 was moderate. A moderate health risk suggests a degraded mission capability in terms of the required mission standard and in reduced mission capability if hazards occurred during the mission (Reference 4, Table 3-2). Confidence in the long-term PM_{10} metals health risk assessment was medium (Reference 4, Table 3-6).

The hazard severity was marginal for average PM_{10} cobalt sample concentrations. The results indicate that for a marginal hazard severity many exposed personnel are plausibly expected to develop delayed onset, irreversible effects (Reference 4, Table 3-4).

2.5.3 Airborne Metals from $PM_{2.5}$

2.5.3.1 Sample data/Notes:

A total of 143 valid $PM_{2.5}$ airborne metal samples were collected from 2005–2011, no $PM_{2.5}$ airborne metal samples were taken prior to 2005. $PM_{2.5}$ cadmium was above acute MEGs in 2006 and 2009, $PM_{2.5}$ lead was above acute MEGs in 2009. $PM_{2.5}$ cobalt was above chronic MEGs in 2006.

2.5.3.2 Short-term health risks:

Low. The short-term health risk assessment for peak and average sample concentrations for $PM_{2.5}$ cadmium in 2006 and 2009 and $PM_{2.5}$ lead in 2009 was low. A low health risk suggests little or no impact on accomplishing the mission (Reference 4, Table 3-2). Confidence in the short-term $PM_{2.5}$ metals health risk assessment was medium (Reference 4, Table 3-6).

The hazard severity was negligible for average and peak $PM_{2.5}$ cadmium and cobalt sample concentrations. The results indicate that for a negligible hazard severity few exposed personnel (if any) are expected to have noticeable health effects during mission. Exposed personnel are expected to be able to effectively perform all critical tasks during mission operations. Minimal to no degradation of abilities to conduct complex tasks are expected (Reference 4, Table 3-4).

2.5.3.3 Long-term health risks:

Moderate. The long-term health risk assessment for sample concentrations for $PM_{2.5}$ cobalt in 2006 was moderate. A moderate health risk suggests limited future medical surveillance activities are anticipated (Reference 4, Table 3-3). Confidence in the long-term $PM_{2.5}$ metals health risk assessment was medium (Reference 4, Table 3-6).

The hazard severity was marginal for average $PM_{2.5}$ cobalt sample concentrations. The results indicate that for a marginal hazard severity many exposed personnel are plausibly expected to develop delayed onset, irreversible effects (Reference 4, Table 3-4).

2.6 Volatile Organic Compounds and Semi-Volatile Organic Compounds

2.6.1 Sample data/Notes:

A total of 40 valid VOC, SVOC air samples were collected in VBC and vicinity from 4 October 2004 to 23 April 2011. No detected VOCs or SVOCs were detected at levels above the long-term MEGs.

2.6.2 Short-term and long-term health risks:

None identified based on available sampling data.

3 Soil

3.1 Site-Specific Sources Identified

3.2 Sample data/Notes:

A total of 135 valid surface soil samples were collected from 2003 to 2011 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 have remained 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. No parameters exceeded 1-year Negligible MEGs for dermal contact. The dust inhalation exposure pathway is addressed in Section 2 above.

4 Water

In order to assess the health risk to U.S. personnel from exposure to water in theater, the Army Public Health Center (Provisional) 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.

4.1 Drinking Water:

4.1.1 Site-Specific Sources Identified

4.1.2 Sample data/Notes:

To assess the potential for adverse health effects to troops, the following assumptions were made about dose and duration: A conservative (protective) assumption was that personnel routinely ingested 5 liters per day (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 twenty-five valid drinking water samples were collected from 2003 to 2011. No parameters exceeded short-term or long-term drinking MEGs.

4.1.3 Short-term and long-term health risk:

None identified based on available sample data.

4.2 Non-Drinking Water: Disinfected

4.2.1 Site-Specific Sources Identified

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

4.2.2 Sample data/Notes:

To assess the potential for adverse health effects to troops the following assumptions were made about dose and duration: All U.S. personnel at this location were expected to remain at this site for approximately 1 year. A conservative (protective) assumption is that personnel routinely consumed less than 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 57 non-drinking water samples from 2003 to 2011 were evaluated for this health risk assessment. Magnesium and sulfate were found in concentrations exceeding the non-drinking negligible short-term 14-day 5L/d MEG in 2003. No parameters exceeded long-term drinking MEGs.

4.2.3 Short-term health risks:

None to Low. The concentrations of magnesium and sulfate exceeded their respective negligible short-term 14-day 5L/d MEGs in 2003 and were assessed as a low health risk. A low short-term health risk suggests little or no impact on accomplishing the mission.

Average yearly magnesium and sulfate concentrations in non-drinking water were below short-term MEGs for all years assessed. The results indicate that magnesium and sulfate are not short-term hazards.

For the highest observed magnesium and sulfate concentrations in non-drinking water the hazard severity was negligible in all years assessed. During peak exposures at the negligible hazard severity a few exposed personnel (if any) are expected to have noticeable health effects during mission. Exposed personnel are expected to be able to effectively perform all critical tasks during mission operations. Minimal to no degradation of abilities to conduct complex tasks are expected.

4.2.4 Long-term health risks:

None identified based on available sample data. There were no long-term MEGs available for magnesium or sulfate, therefore, these chemicals were not retained as potential hazards.

5 Military Unique

5.1 Chemical Biological, Radiological Nuclear (CBRN) Weapons

No specific hazard sources were documented in the Defense Occupational and Environmental Health Readiness System (DOEHRS), or the Military Exposure Surveillance Library (MESL) from the 17 May 2003 through 17 October 2011 timeframe (References 1 and 5).

5.2 Depleted Uranium (DU)

No specific hazard sources were documented in the DOEHRS or MESL from the 17 May 2003 through 17 October 2011 timeframe (References 1 and 5).

5.3 Ionizing Radiation

Ionizing radiation is emitted from medical/dental x-ray, explosive ordnance disposal x-ray, and low-level radioactive materials present in chemical agent monitors and alarms. No worker exposures exceeding radiation exposure standards have been identified.

There were insufficient data with which to characterize short-term or long-term health risk.

5.4 Non-Ionizing Radiation

Multiple radar systems and communication equipment located on Camp Sather emit radio frequency (RF). The systems are marked with warning signs and appropriate training is given to those workers where necessary. There is no documentation of any workers identified as exceeding RF-radiation permissible exposure limits (Reference 14).

There were insufficient data with which to characterize short-term or long-term health risk.

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. USCENTCOM MOD 12 (Reference 6) lists deployment requirements, to include immunizations and chemoprophylaxis, in effect during the timeframe of this POEMS.

6.1 Food borne and Waterborne Diseases

Food borne and waterborne diseases in the area are transmitted through the consumption of local food and water. Local unapproved food and water sources (including ice) are heavily contaminated with pathogenic bacteria, parasites, and viruses to which most U.S. Service Members have little or no natural immunity. Effective host nation disease surveillance does not exist within the country. Only a small fraction of diseases are identified or reported in host nation personnel. Diarrheal diseases are expected to temporarily incapacitate a very high percentage of U.S. personnel within days if local food, water, or ice is consumed. Hepatitis A and typhoid fever infections typically cause prolonged illness in a smaller percentage of unvaccinated personnel. Vaccinations are required for DOD personnel and

contractors. In addition, although not specifically assessed in this document, significant outbreaks of viral gastroenteritis (e.g., norovirus) and food poisoning (e.g., *Bacillus cereus*, *Clostridium perfringens*, *Staphylococcus*) may occur. Key disease risks are summarized below:

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

6.1.1 Diarrheal diseases (bacteriological)

High, mitigated to Low: Diarrheal diseases are expected to temporarily incapacitate a very high percentage of personnel (potentially over 50% per month) within days if local food, water, or ice is consumed. Mitigation strategies in place include consumption of approved food, water, and ice; hand washing; and applied food/water safety mechanisms. Field conditions (including lack of hand washing and primitive sanitation) may facilitate person-to-person spread and epidemics. Typically, diarrheal diseases are a mild disease treated in an outpatient setting with 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 strategies in place include immunization, consumption of approved food, water, and ice; hand washing; and applied food/water safety mechanisms. U.S. Personnel did not drink untreated water, and vaccination for Hepatitis A is required for deployment into the CENTCOM Area or Responsibility (AOR). 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:

Variable, unmitigated; Low, mitigated: 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 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 support populations of arthropod vectors, including mosquitoes, ticks, mites, and sandflies. Significant disease transmission is sustained countrywide, including urban areas. 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

None: Indigenous transmission of malaria in Iraq was eliminated as of 2008 reducing risk among personnel exposed to mosquito bites to None.

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. Mitigation strategies in place include Individual Protective Measures (IPM) practices, permethrin treated uniforms, pesticides, reduction of pest/breeding habitats, and engineering controls. 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 results in debilitating febrile illness requiring 1 to 7 days of supportive care followed by return to duty.

6.2.5 Sindbis (and Sindbis-like viruses)

Low: Sindbis and sindbis-like viruses are maintained in a bird-mosquito cycle in rural areas and occasionally caused limited outbreaks among humans. The viruses are transmitted by a variety of *Culex* mosquito species found primarily in rural areas. A variety of bird species may serve as reservoir or amplifying hosts. Extremely rare cases (less than 0.01% per month attack rate) could have occurred seasonally (April - November). Debilitating febrile illness often accompanied by rash, typically requires 1 to 7 days of supportive care; significant arthralgias may persist for several weeks or more in some cases. This disease is associated with a low health risk estimate.

6.2.6 Rickettsioses, tickborne (spotted fever group)

Low: Rare cases (less than 0.1% per month) of rickettsioses disease are possible among personnel exposed to tick bites. Rickettsioses are transmitted by multiple species of hard ticks, including *Rhipicephalus* spp., which are associated with dogs. Other species of ticks, including *Ixodes* are also capable of transmitting rickettsial pathogens in this group. In addition to dogs, various rodents and other animals also may serve as reservoirs. Ticks are most prevalent from April through November.

Incidents can result in debilitating febrile illness, which may require 1 to 7 days of supportive care followed by return to duty. The health risk of rickettsial disease is Low.

6.2.7 Typhus-murine (fleaborne)

Low: Typhus-murine has a Low risk estimate and is assessed as present, but at unknown levels. Rare cases are possible among personnel exposed to rodents (particularly rats) and flea bites. Incidents may result in debilitating febrile illness typically requiring 1 to 7 days of supportive care followed by return to duty.

6.2.8 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 risk is moderate for leishmaniasis - cutaneous (acute), Crimean-Congo hemorrhagic fever, and sandfly fever; Low for, sindbis, rickettsioses-tickborne, typhus-fleaborne, and West Nile fever. No hazard from malaria (2008 - 2011). 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.

6.2.10 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

Tactical operations or recreational activities that involve extensive contact with surface water such as lakes, streams, rivers, or flooded fields may result in significant exposure to leptospirosis and schistosomiasis. Arid portions of Iraq without permanent or persistent bodies of surface water do not support transmission of leptospirosis or schistosomiasis. Risk was restricted primarily to areas along rivers and lakes. These diseases can debilitate personnel for up to a week or more. Leptospirosis 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 exposure to enteric diseases including 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 including bacterial or fungal dermatitis. Mitigation strategies were in place and included avoiding water contact and recreational water activities, proper wear of uniform (especially footwear), and protective coverings for cuts/abraded skin.

6.3.1 Leptospirosis

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

skin, mucous membranes, and conjunctivae. Infection may also occur from ingestion of contaminated water. The acute, generalized illness associated with infection may mimic other tropical diseases (for example, dengue fever, malaria, and typhus), and common symptoms include fever, chills, myalgia, nausea, diarrhea, cough, and conjunctival suffusion. Manifestations of severe disease can include jaundice, renal failure, hemorrhage, pneumonitis, and hemodynamic collapse. Recreational activities involving extensive water contact may result in personnel being temporarily debilitated with leptospirosis. Mitigation strategies in place include avoiding water contact and recreational water activities; proper wear of uniform, especially footwear, and protective coverings for cuts/abraded skin. This disease is associated with a Moderate health risk estimate.

6.3.2 Schistosomiasis

Moderate, mitigated to Low: Humans are the principal reservoir for schistosomes; humans shed schistosome eggs in urine or feces. Animals such as cattle and water buffalo may also be significant reservoirs. Rare cases (less than 0.1% per month attack rate) may occur seasonally (typically April through November) among personnel wading or swimming in lakes, streams, or irrigated fields which were frequently contaminated with human and animal waste containing schistosome eggs. In groups with prolonged exposure to heavily contaminated foci, attack rates may exceed 10%. Exceptionally heavy concentrations of schistosomes may occur in discrete foci, which were difficult to distinguish from less contaminated areas. In non-immune personnel exposed to such foci, rates of acute schistosomiasis may be over 50%. Mild infections are generally asymptomatic. In very heavy acute infections, a febrile illness (acute schistosomiasis) may occur, especially with *Schistosoma japonicum* and *S. mansoni*, requiring hospitalization and convalescence over 7 days. This disease is associated with a Moderate health risk estimate.

6.3.3 Short-term health risks:

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

6.3.4 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. Mitigation strategies include routine medical screenings; enforcing minimum space allocation in housing units; implementing head-to-toe sleeping in crowded housing units; and implementation of proper personal protective equipment (PPE), when necessary (treating active case, detainee operations). 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 were the primary reservoir of rabies in Iraq, and a frequent source of human exposure. In June 2008, the New Jersey Health department in the U.S. reported a confirmed case of rabies in a mixed-breed dog recently imported from Iraq. 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. No cases of rabies acquired in Iraq have been identified in U.S. Service Members to date. The vast majority (>99%) of persons who develop rabies disease will do so within a year after a risk exposure, there have been rare reports of individuals presenting with rabies disease up to six years or more after their last known risk exposure. Mitigation strategies included command emphasis of CENTCOM GO 1B, reduction of animal habitats, active pest management programs, and timely treatment of feral animal scratches/bites.

6.5.2 Anthrax

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

6.5.3 Q-Fever

Moderate, mitigated to Low: Potential health risk to U.S. personnel is Moderate, but mitigated to Low, year round. Rare cases are possible among personnel exposed to aerosols from infected animals, with clusters of cases possible in some situations. Significant outbreaks (affecting 1-50%) can occur in personnel with heavy exposure to barnyards or other areas where animals are kept. Unpasteurized milk may also transmit infection. The primary route of exposure is respiratory, with an infectious dose as low as a single organism. Incidence could result in debilitating febrile illness, sometimes presenting as pneumonia, typically requiring 1 to 7 days of inpatient care followed by return to duty. Mitigation strategies in place as listed in paragraph 6.5.2 except for vaccinations.

6.5.4 H5N1 avian influenza

Low: Potential health risk to U.S. personnel is Low. Although H5N1 avian influenza (AI) is easily transmitted among birds, bird-to-human transmission is extremely inefficient. Human-to-human transmission appears to be exceedingly rare, even with relatively close contact. Extremely rare cases (less than 0.01% per month attack rate) could occur. Incidence could result in very severe illness with fatality rate higher than 50 percent in symptomatic cases. Mitigation strategies included avoidance of birds/poultry and proper cooking temperatures for poultry products.

6.5.5 Short-term health risks:

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

6.5.6 Long-term health risks:

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

7 Venomous Animal/Insect

All information was taken directly from the Armed Forces Pest Management Board (Reference 7) and the Clinical Toxinology Resources web site from the University of Adelaide, Australia (Reference 8). The species listed below have home ranges that overlap the location of VBC and vicinity and vicinity, and may present a health risk if they are encountered by personnel. See Section 9 for more information about pesticides and pest control measures.

7.1 Spiders

- *Latrodectus pallidus*: Clinical effects uncertain, but related to medically important species, therefore major envenoming cannot be excluded.

7.2 Scorpions

- *Androctonus crassicauda* (black scorpion): Severe envenoming possible and potentially lethal, however most stings cause only severe local pain.

- *Buthacus leptochelys*, *Buthacus macrocentrus*, *Compsobuthus matthiesseni*, *Compsobuthus werneri*, *Mesobuthus caucasicus, Mesobuthus eupeus, Orthochirus iraqus*, and *Orthochirus scrobiculosus*: Clinical effects unknown; there are a number of dangerous Buthid scorpions, but there

are also some known to cause minimal effects only. Without clinical data it is unclear where this species fits within that spectrum.

- *Hemiscorpius lepturus*: Severe envenoming possible, potentially lethal.

- *Hottentotta saulcyi*, *Hottentotta scaber*, and *Hottentotta schach*: Moderate envenoming possible but unlikely to prove lethal.

7.3 Snakes

- *Cerastes gasperettii*: Potentially lethal envenoming, though unlikely.

- *Malpolon moilensis*, *Malpolon monspessulanus*, *Pseudocyclophis persicus, and Pseudocyclophis persicus fieldi*: Clinical effects varies, but unlikely to cause significant envenoming.

- *Macrovipera lebetina* subspecies *euphratica* and subspecies *obtusa, Vipera albicornuta*, and *Walterinnesia aegyptia*: Severe envenoming possible, potentially lethal.

7.4 Short-term health risk:

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

7.5 Long-term health risk:

None identified.

8 Heat/Cold Stress

8.1 Heat

Summer (June - September) monthly mean temperatures range from 87 degrees Fahrenheit (°F) to 94°F with an average temperature of 91°F based on historical climatological data. The health risk of heat stress/injury based on temperatures alone is Low (< 78°F) from November – March, High (82-87.9°F) in April, and extremely high (≥ 88°F) from May – October. However, work intensity and clothing/equipment worn pose greater health risk of heat stress/injury than environmental factors alone (Reference 9). Managing risk of hot weather operations included monitoring work/rest periods, proper hydration, and taking individual risk factors (e.g., acclimation, weight, and physical conditioning) into consideration. Risk of heat stress/injury was reduced with preventive measures

8.1.1 Short-term health risk:

Low to High, mitigated to Low. 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 Extremely High from May – October, High in April, and Low from November – March. The risk of heat injury was reduced 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 4, Table 3-6).

8.1.2 Long-term health risk:

Low. However, the risk may be greater for certain susceptible persons–those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions. Long-term health implications from heat injuries are rare but may occur, especially from more serious injuries such as heat stroke. It is possible that high heat in conjunction with various chemical exposures may increase long-term health risks, though specific scientific evidence is not conclusive. Confidence in these risk estimates is medium (Reference 4, Table 3-6).

8.2 Cold

8.2.1 Short-term health risks:

Winter (December - March) temperatures range from 50°F to 60°F with an average temperature of 54.5°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 (Reference 9).

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

8.2.2 Long-term health risk:

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

9 Noise

9.1 Continuous

There are numerous stand-alone generators located throughout VBC, and there have been some reports of unenclosed generators without any kind of noise control measures. However, for the general population noise, levels above the hearing protection threshold are for short durations and daily average exposures are below levels requiring hearing protection. Appropriate signs are posted and all military personnel are issued hearing protection (References 11, 12, 13, 15).

There are also aircraft (Reference 15), aircraft ground equipment, tools and various industrial equipment that contribute to noise levels. Buildings and work sites within flight lines are exposed to flight noise. Workers are provided appropriate protective equipment where needed.

9.1.1 Short-term health risks:

Not evaluated.

9.1.2 Long-term health risks:

Not evaluated.

9.2 Impulse

No impulse noise evaluations conducted, not evaluated.

9.2.1 Short-term health risks:

Not evaluated.

9.2.2 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

Solid waste is collected from trash receptacles throughout VBC and disposed of through two solid waste incinerators. Both incinerators burn at a capacity of 40 tons/day per incinerator during the week, the maximum capacity of each incinerator is 60 tons/day. The incinerator ash is transported to a holding area adjacent to the incinerator for a minimum of 30 days and then transported to a landfill. Medical waste is collected, documented and incinerated in a medical waste incinerator operated by KBR (References 11-12).

In 2010 solid and liquid waste was collected and removed from JSS Constitution by contractors. No burn pit was used at JSS Constitution (Reference 16).

In 2005 solid waste and waste water at Camp Cropper was removed by contractors, however a burn pit was used as a last resort in 2005 and 2006 and was used to dispose of paper documents at the Detainee Warehouse in 2007 (References 17-21). A waste water treatment plant was in place and operational at Camp Cropper in 2008 (Reference 22).

In 2010 solid waste and waste water from Camp Liberty, Camp Sather, LB Seitz, Camp Striker, and Camp Victory was collected and disposed of at Camp Liberty (References 23-30).

There were insufficient data with which to characterize short-term or long-term health risk.

10.3 Fuel/petroleum products/industrial chemical spills

There is one bulk fuel farm located in the industrial zone of VBC. This site maintains 18 50,000-gallon blivets for jet propellant, four 50,000-gallon blivets for diesel, and two 50,000-gallon blivets for motor gasoline. The fuel farm site is located on a slight gradient to the northeast. All blivets are stored in secondary containment and confined in earthen berms. No spills or history of past releases have been identified at this location. There is mention of underground storage tanks (UST) located on VBC; however, no specifics as to number of USTs or locations were found except for the mention of one uncontrolled UST that contains used oil. No chemical spills were noted in any of the documents (References 11-12).

There were insufficient data with which to characterize short-term or long-term health risk.

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. Monthly pesticide application reports in the MESL for VBC and vicinity 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 of how each pesticide was handled and applied (see below).

10.4.1 Rodenticides

Bromadiolone, brodifacoum, and sodium diphacinone were used to control rodents.

10.4.2 Insecticides

Insecticides used to control ants, cockroaches, crickets, flies, mosquitoes, spiders, and termites included abamectin B1, Bacillus thuringiensis subspecies israelensis, bifenthrin, cypermethrin, deltamethrin, diphacinone, d-trans Allethrin, fipronil, hydramethylnon, imidacloprid, lambda-cyhalothrin, methomyl, methoprene, n,n-diethyl-m-toluamide, permethrin, phenothrin, piperonyl butoxide, poly(oxy-1,2-ethanediyl) alpha-isooctadecyl-omegahydroxy, pyrethrins, resmerithrin , ß-cyfluthrin, and z-9-tricosene.

10.4.3 Reptilicides

Naphthalene and sulfur were used to control snakes.

10.4.4 Short-term and long-term health risks

No specific hazard sources were documented in the DOEHRS or MESL from the 17 May 2003 through 17 October 2011 timeframe.

10.5 Asbestos

The environmental health site assessment for VBC that was completed in March 2006 did not find any friable asbestos at the site. However, there were two specific asbestos sampling events were performed at VBC. One at the Insulation site at Camp Slayer on 10 March 2005 and the other sampling event was done at the East BIAP DFAC on 15 February 2008. There was one suspect sample taken from an insulation site at Camp Slayer that was determined to contain 20% chrysotile asbestos. There was no indication of whether the sample was considered friable or non-friable. No further information was reported as to a determination of health risks associated with this sample or if any remediation was done. The environmental health site assessment for VBC (Reference 11), reported there was no evidence of friable asbestos at the site. The sampling event at the DFAC on East BIAP involved one sample of green transit, five dust wipe samples, and two grout samples. Only the green transit building material came back positive for asbestos containing material with 29.6% Chrysotille fibers. The report did not mention what state the green transit building material was in but renovations were allowed to proceed with certain precautionary measures put in place to not disturb the state of the green transit building material and to prevent any exposure to the asbestos material. Based on these reports occupational health measures to reduce exposure to asbestos would be required, but without knowing the state of the asbestos containing material no determination of a health risk is possible at this time.

10.6 Lead Based Paint

No specific hazard sources were documented in the DOEHRS or MESL from the 17 May 2003 through 17 October 2011 timeframe.

10.7 Burn Pit

While not specific to VBC and vicinity, the consolidated epidemiological and environmental sampling and studies on burn pits that have been conducted as of the date of this publication have been unable to determine whether an association does or does not exist between exposures to emissions from the burn pits and long-term health effects (Reference 10). The Institute of Medicine committee's (Reference 10) review of long-term health consequences of exposure to burn pits in Iraq and Afghanistan 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 or near the burn pit. Such health effects would be due mainly to high ambient concentrations of PM from both natural and anthropogenic sources, including military sources. If that broader exposure to air pollution turns out to be relevant, potentially related health effects of concern are respiratory and cardiovascular effects and cancer. Susceptibility to the PM health effects could be exacerbated by other exposures, such as stress, smoking, local climatic conditions, and co-exposures to other chemicals that affect the same biologic or chemical processes. Individually, the chemicals measured at burn pit sites in the study were generally below concentrations of health concern for general populations in the U.S. However, the possibility of exposure to mixtures of the chemicals raises the potential for health outcomes associated with cumulative exposure to combinations of the constituents of burn pit emissions and emissions from other sources.

To characterize risk to personnel who were specifically exposed to emissions from burn pits and incinerators located in the vicinity of VBC, only air samples associated with a burn pit or incinerator at VBC and vicinity were included in the following assessment of the air at VBC and vicinity.

10.7.1 Particulate matter, less than 10 micrometers (PM_{10}) Associated with Burn pits or Incinerator Emissions

10.7.1.1 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.

10.7.1.2 Sample data/Notes:

A total of 88 valid PM_{10} air samples identified with burn pits or incinerators were collected from 2003–2009. The range of 24-hour PM_{10} concentrations was 23 $\mu g/m^3$ – 892 $\mu g/m^3$ with an average concentration of 296 $\mu g/m^3$.

10.7.1.3 Short-term health risks:

Variable (Low to High). The short-term PM_{10} health risk assessment is variable (Low to High) based on average and peak PM_{10} sample concentrations, and the likelihood of exposure at these hazard severity levels. The variable risk is due to significant fluctuation in daily concentrations. Risk from peak exposures was high 2005. Risk from average exposures was low in 2005. There were not enough samples associated with burn pits or incinerators taken in 2003, 2004, 2006, 2007, and 2009 to assess the health risk. A low health risk suggests little or no impact on accomplishing the mission. A high health risk suggests a 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 standard if hazards occur during the mission (Reference 4, Table 3-2). Daily average health risk levels for PM_{10} samples associated with burn pits or incinerators show no hazard for 53%, low health risk for 26%, moderate health risk for 9%, and high health risk for 12% of the time. Confidence in the short-term PM_{10} health risk assessment is low (Reference 4, Table 3-6).

The hazard severity for average PM_{10} concentrations in samples was negligible in 2005. The results indicate that for negligible hazard severity 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 4, Table 3-11).

For the highest observed PM_{10} sample concentration in 2005, the hazard severity was critical. During peak exposures at the critical hazard severity level, most if not all personnel experience 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. 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 4, Table 3-11).

10.7.1.4 Long-term health risk:

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

10.7.2 Particulate matter, less than 2.5 micrometers ($PM_{2.5}$) Associated with Burn pits or Incinerator Emissions

10.7.2.1 Exposure Guidelines

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

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

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

- Negligible MEG = 15
- Marginal MEG = 65

10.7.2.2 Sample data/Notes:

A total of 15 valid $PM_{2.5}$ air samples identified with burn pits or incinerators were collected in 2006, 2009, and 2010. The range of 24-hour $PM_{2.5}$ concentrations was 32 $\mu g/m^3$ – 197 $\mu g/m^3$ with an average concentration of 88 $\mu g/m^3$.

10.7.2.3 Short-term and long-term health risks:

There were insufficient data with which to characterize short-term or long-term health risk from exposure to PM2.5 samples collected near burn pits or incinerators.

10.7.3 Airborne Metals from PM_{10} Associated with Burn pits or Incinerator Emissions

10.7.3.1 Sample data/Notes:

A total of 88 valid PM_{10} airborne metal samples associated with burn pits or incinerators were collected at VBC and vicinity from 2003 to 2009. PM_{10} lead detected was above an acute MEG in 2005.

10.7.3.2 Short-term health risks:

Low. The short-term health risk assessment for peak sample concentrations for PM_{10} lead in 2005 was low. There were not enough samples associated with burn pits or incinerators taken in 2003, 2004, 2006, 2007, and 2009 to assess the health risk. Average sample concentrations for PM_{10} lead in 2005 were not an acute hazard. A low health risk suggests little or no impact on accomplishing the mission (Reference 4, Table 3-2). Confidence in the short-term PM_{10} metals health risk assessment was medium (Reference 4, Table 3-6).

The hazard severity was negligible for peak PM_{10} lead sample concentrations. The results indicate that for a negligible hazard severity few exposed personnel (if any) are expected to have noticeable health effects during mission. Exposed personnel are expected to be able to effectively perform all critical tasks during mission operations. Minimal to no degradation of abilities to conduct complex tasks are expected (Reference 4, Table 3-4).

10.7.3.3 Long-term health risks:

None identified based on available sampling data.

10.7.4 Airborne Metals from $PM_{2.5}$ Associated with Burn pits or Incinerator Emissions

10.7.4.1 Sample data/Notes:

A total of 15 valid $PM_{2.5}$ airborne metal samples associated with burn pits or incinerators were collected from 2006–2010, no $PM_{2.5}$ airborne metal samples associated with burn pits or incinerators were taken prior to 2006 or after 2010.

10.7.4.2 Short-term and long-term health risks:

There were insufficient data with which to characterize short-term or long-term health risk from exposure to PM2.5 samples collected near burn pits or incinerators.

10.7.5 Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs) Associated with Burn pits or Incinerator Emissions

10.7.5.1 Sample data/Notes:

A total of 22 valid VOC and SVOC air samples identified with burn pits were collected in VBC and vicinity from 2004 to 2011. No VOCs or SVOCs were detected.

10.7.5.2 Short-term and long-term health risks:

There were insufficient data with which to characterize short-term and long-term health risk from exposure to VOCs and SVOCs, however no parameters exceeded 1-year MEGs.

10.8 Lithium Battery Warehouse Fire

A week-long fire took place at a lithium battery warehouse near Camp Brooklyn in 2009. Air sampling results indicated that sulfur dioxide did not appear to substantially impact the overall air quality of Camp Brooklyn or VBC but was a potential acute hazard concern. First responder personnel wore self-contained breathing apparatuses and were not exposed to sulfur dioxide emissions. Personnel outside of the hazard zone may have experienced mild irritation of the eyes or respiratory tract for a short-term duration and such exposures were not likely severe enough to pose a chronic, long-term health hazard. However individuals affected by exposure to the emissions were not identified (Reference 31).

11 References[1]

1. Defense Occupational and Environmental Health Readiness System (referred to as the DOEHRS-EH database) at https://doehrs-ih.csd.disa.mil/Doehrs/. Department of Defense (DoD) Instruction 6490.03, *Deployment Health*, 2006.

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

3. Joint Staff Memorandum (MCM) 0017-12, Procedures for Deployment Health Surveillance, 2012.

4. USAPHC TG230, June 2013 Revision.

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

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

6. Modification 12 to United States Central Command Individual Protection and Individual Unit Deployment Policy, 02 December 2013.

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

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

9. Goldman RF. 2001. Introduction to heat-related problems in military operations. In: Textbook of military medicine: medical aspects of harsh environments Vol. 1, Pandolf KB, and Burr RE (Eds.), Office of the Surgeon General, Department of the Army, Washington DC.

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

11. Environmental Health Site Assessment (EHSA) Victory Base Complex (VBC), 2006.

12. Environmental Baseline Survey (EBS) for Victory Base, Iraq, 2003.

13. Environmental Health Site Assessment (ESHA) for Sather Air Force Base, 12 August 2005.

14. Sather Air Force Base Environmental Health Assessment Review and Update, 21 April 2010, June 2010.

15. 926th Medical Detachment. Base Camp Assessment Team Preventive Medicine Report Sather Air Base. December 2010.

16. 2-1 AAB. USA-C Base Camp Assessment JSS Constitution. 14 December 2010.

17. 898th Medical Detachment. Base Camp Assessment of Camp Cropper. 21 December 2005.

18. 12th Medical Detachment. Base Camp Assessment of Camp Cropper. 26 April 2005.

19. 898th Medical Detachment. Base Camp Assessment Report: Cropper. 13 February 2006.

20. 898th Medical Detachment. Base Camp Assessment Report: Camp Cropper. 23 January 2006.

21. 535th Military Police Battalion. Base Camp Assessment of Camp Cropper. 31 August 2007.

22. HHC, 324th Military Police Battalion. Base Camp Assessment of Camp Cropper. 29 February 2008.

23. 926th Medical Detachment. Base Camp Assessment Team Preventive Medicine Report Camp Liberty-West. December 2010.

24. 926th Medical Detachment. Base Camp Assessment Team Preventive Medicine Report Camp Liberty-East. December 2010.

25. 926th Medical Detachment. Base Camp Assessment Team Preventive Medicine Report Sather Air Base. December 2010.

26. 926th Medical Detachment. Base Camp Assessment Team Preventive Medicine Report Log Base Seitz. December 2010.

27. 926th Medical Detachment. Base Camp Assessment Team Preventive Medicine Report Camp Striker. October 2010.

28. 926th Medical Detachment. Base Camp Assessment Team Preventive Medicine Report Camp Striker. December 2010.

29. 926th Medical Detachment. Base Camp Assessment Team Preventive Medicine Report Camp Victory. October 2010.

30. 926th Medical Detachment. Base Camp Assessment Team Preventive Medicine Report Camp Victory. December 2010.

31. USAPHC. Medical Concerns Regarding Deployment Exposure Incidents: 2009 Iraqi Lithium Battery Warehouse Fire. Fact Sheet 64-020-0212.

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 Public Health Center Phone: (800) 222-9698. http://phc.amedd.army.mil/
Navy and Marine Corps Public Health Center (NMCPHC) (formerly NEHC) Phone: (757) 953-0700. http://www-nehc.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, Deputy Assistant Secretary of Defense for Health Readiness Policy and Oversight (HRP&O) Phone: (800) 497-6261. http://fhpr.dhhq.health.mil/home.aspx