Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Base Camp Jebel Ali, Dubai, United Arab Emirates (UAE): January 2012 through December 2015

AUTHORITY: This Periodic Occupational and Environmental Monitoring Summary (POEMS) has been developed in accordance with Department of Defense (DOD) Instructions (DODI) 6490.03 and 6055.05, and Joint Staff memorandum MCM 0017-12, *See Section 11, References.*

PURPOSE: This POEMS documents the DOD assessment of occupational and environmental health (OEH) risk for Base Camp Jebel Ali, Dubai, United Arab Emirates (UAE). It presents a qualitative summary of health risks identified at this location and their potential medical implications. The report is based on information collected from January 2012 through December 2015. This information includes OEH monitoring data.

This assessment assumes that environmental sampling at Base Camp Jebel Ali 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 January 2012 through December 2015 unless stated otherwise in the discussions.

The POEMS can inform healthcare providers and others of environmental conditions experienced by individuals deployed to Base Camp Jebel Ali during the period of this assessment; however, it does not represent an individual exposure profile. Individual exposures depend on many variables, including the duration, frequency, and location of the activities a person performs 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 potential OEH exposures while deployed should have exposure/treatment noted in their medical record on a Standard Form (SF) 600 (Chronological Record of Medical Care).

Health protective exposure assumptions are used in assessing all health risks. For example, individuals are assumed to be constantly exposed (24 hours/day, 7 days/week) to the environmental conditions measured. Small groups of personnel assigned to Base Camp Jebel Ali may be at greater risk than the general population due to operational requirements; these groups are identified when appropriate.

SITE DESCRIPTION: Base Camp Jebel Ali is located in the Port of Jebel Ali, Dubai, UAE approximately 25 miles southwest of the City of Dubai. The base camp consists of approximately 42 acres adjacent to berths 59, 60 and 61 within the port. The site is flat with an elevation of approximately 18 feet above sea level. The base camp was first leased from the Dubai Port Authority (now Dubai Port World) by the U.S. Navy in 2005 for use in ship support, crew recreation, and storage facilities. The site originally occupied only 25 acres adjacent to berth 59. It was expanded to its current footprint in 2009 with the addition of berth 60 and 61 properties. Prior to U.S. Navy usage, the property supported a variety of industrial operations primarily comprised of demolition, ship construction and repair, which included the fabrication of ship parts and a scrap yard. Thus, the Naval Facilities Engineering Command conducted environmental assessments to determine if prior site use posed any potential health risks to future occupants. Areas containing environmental impairment were remediated by Dubai Port World prior to U.S. Navy site occupation.

Base Camp Jebel Ali is now one of the most frequented ports outside of the United States. It supports U.S. Navy units that provide patrol boat escort operations for inbound and outbound U.S. vessels and provides warehouse space for the storage of cargo, petroleum, oils, lubricants and mail. The base

camp is also home to the Jebel Ali Recreation Center, which is equipped with the semi-permanent liberty facilities of the Kasbah Liberty Center. These include international phone center, game room, souvenir shops, and food stalls (e.g., Burger King, Subway, Caribou Coffee, and Pizza Uno). Base camp infrastructure primarily consists of a large tent for patrol boat maintenance, several trailers for office space and recreation facilities, and a large prefabricated metal warehouse. The ground is covered with concrete pavers. Power is supplied from a combination of commercial generators, tactical generators and the municipal power grid. Water for cooking, personal hygiene and cleaning is supplied by the Dubai Electricity and Water Authority. U.S. Army Veterinary Corps approved bottled water is supplied from Emirates Natural Drinking Water™ for drinking.

Approximately 200 U.S. Service members are assigned to Base Camp Jebel Ali. They work onsite from 8-12 hours/day and live in contracted living quarters in the adjacent community during off duty hours. Base Camp Jebel Ali is subject to an influx of several hundred additional personnel while U.S. Navy and/or allied ships are in port. These port visits typically last 3-5 days. For U.S. Navy port visits, U.S. Service members take advantage of the liberty facilities at the base camp and tour various sites within the UAE.

CLIMATE: Dubai weather is characterized as a tropical desert climate with hot, sunny conditions from its proximity to the Tropic of Cancer and the Northern desert belt. Dubai's climate varies from region to region, with temperatures and humidity differing between the coastline and desert. Humidity is higher on the coastline than in the dry desert heat. Summer months (from April to December) are very hot and dry with temperatures climbing to 104°F or higher and rarely dropping below 86°F. Coastal humidity exceeds 85% for most of the summer due to the Sharqi, a humid southeastern wind. Winter months (from December to March) are warm with average highs of 73°F and lows of around 57°F. During winter, temperatures on the coastline are warmer, while those in the desert are much cooler. Dubai typically receives about 6 inches of rain per year. Most of Dubai's annual rainfall occurs during the winter months. February is the wettest month, averaging 1.4 inches of rainfall, and June is the driest month with little to no rain. During the summer months, low pressure systems developing over Saudi Arabia may create strong north-westerly winds, known as the Shamal, in Dubai. The Shamal stirs up the surrounding desert sands, reducing visibility and occasionally creating sandstorms that may last for days.

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 Base Camp Jebel Ali. As indicated in the detailed sections that follow Table 2, established controls that reduce health risk have been 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 and medical implications:

The following may have caused acute health effects in some individuals ***during deployment*** at Base Camp Jebel Ali.

Inhalation of dust: Fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) is routinely present in the air in the UAE at higher concentrations than would typically be experienced in the United States. Air sampling data for $PM_{2.5}$ for at least one 24-hour period during December 2015 revealed a **high** short-term health risk. For all other periods the short-term risk was low. Inhalation of $PM_{2.5}$ at these concentrations may have resulted in mild to more serious short-term health effects (e.g., eye, nose, throat and lung irritation, coughing, sneezing, runny nose and shortness of breath). It is likely that some individuals sought treatment for acute respiratory irritation during the period of elevated health risk. Individuals who sought medical treatment for these symptoms while deployed should have exposure/treatment noted in their medical record.

Heat injury: The short-term health risk of heat injury for unacclimated individuals (i.e., onsite less than four weeks) and those with underlying health conditions is **moderate**. For all other individuals, the risk is **low**.

Long-term health risks and medical implications:

The following may be associated with long-term health effects in some individuals who deployed to Base Camp Jebel Ali***.***

Inhalation of dust: The inhalation of fine particulate matter ($PM_{2.5}$) poses a potential long-term health risk to individuals deployed to Base Camp Jebel Ali. Individuals who routinely worked outdoors and inhaled $PM_{2.5}$ at levels present at the camp during 2014 and 2015 may develop health conditions such as chronic bronchitis, reduced lung function, and asthma. Individuals with a history of asthma or pre-existing cardiopulmonary disease are likely at greatest risk. At this time, there are no specific recommended post-deployment medical surveillance evaluations for individuals with particulate exposures. Providers should consider health status (e.g., any underlying conditions/susceptibilities) and unique OEH exposures (such as welding fumes and burn pit smoke) when addressing individual concerns. Although short-term effects from exposure to dust should have resolved post-deployment, providers should be prepared to consider the relationship between potential deployment exposures and current complaints.

Table 2: Population-Based Health Risk Estimates – Base Camp Jebel Ali, Dubai, UAE[1,2]

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented[5]	Residual Health Risk Estimate[4]
Air			
Particulate matter less than 10 microns in diameter (PM_{10}) *(see paragraph 2.3)*	Short-term: **Low.** Daily levels vary. Acute health effects (e.g., eye and/or upper respiratory tract irritation) may be more pronounced during peak exposure periods. More serious effects were possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).	Air-conditioned living and working spaces provided. For those not working in air conditioned spaces, time outdoors is minimized and doors or tent flaps remain closed. Soils on the base camp are covered by concrete pavers.	Short-term: **Low** overall but there were at least four periods during which health risk was elevated to **moderate.**
	Long-term: **No available health guidelines.**		Long-term: **No available health guidelines.**
Particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) *(see paragraph 2.4)*	Short-term: **Low to high.** Mild acute (short-term) health effects such as eye, nose, or throat irritation are likely in individuals who spent much of their time outdoors especially during periods of peak exposure. Existing medical conditions (e.g., asthma or respiratory diseases) may be exacerbated.	Air-conditioned living and working spaces provided. For those not working in air conditioned spaces, time outdoors is minimized and doors or tent flaps remain closed. Soils on the base camp are covered by concrete pavers.	Short-term: **Low to high.**
	Long-term: **Low to moderate.** Repeated exposures to airborne concentrations of $PM_{2.5}$ that carry a moderate long-term health risk may increase the possibility for development of chronic health conditions in some troops. These conditions include reduced lung function, chronic bronchitis, chronic obstructive pulmonary disease (COPD), asthma, and other cardiopulmonary diseases. Those with a history of asthma or pre-existing cardiopulmonary disease have a higher risk for developing these chronic conditions.		Long-term: **Low to Moderate.**
Airborne metals *(see paragraph 2.5)*	Short-term: **None identified.**	Air-conditioned living and working spaces provided. For those not working in air conditioned spaces, time outdoors is minimized and keeping doors or tent flaps closed. Soils on the base camp are covered by concrete pavers.	Short-term: **None identified.**
	Long-term: **None identified.**		Long-term: **None identified**.

Table 2: Population-Based Health Risk Estimates – Base Camp Jebel Ali, Dubai, UAE[1,2]			
Source of Identified Health Risk[3]	**Unmitigated Health Risk Estimate[4]**	**Control Measures Implemented[5]**	**Residual Health Risk Estimate[4]**
Volatile Organic Compounds (VOC) *(see paragraph 2.6)*	Short-Term: **None identified.** All VOCs detected were below their respective short-term military exposure guidelines.	Living and working areas are located away from roadways and other fuel combustion sources as much as is practical.	Short-Term: **None identified.**
	Long-term: **Not evaluated**; insufficient data exist upon which to base a health risk assessment.		Long-term: **Low.**
Semi-volatile organic compounds *(see paragraph 2.7)*	Short-term: **Not evaluated**; insufficient data exist upon which to base a health risk assessment.	Locate living and working areas away from roadways, runways and other fuel combustion sources.	Short-term: **Not evaluated**; insufficient data exist upon which to base a health risk assessment.
	Long-term: **Not evaluated**; insufficient data exist upon which to base a health risk assessment.		Long-term: **Not evaluated**; insufficient data exist upon which to base a health risk assessment.
Diesel exhaust *(see paragraph 2.8)*	Short-term: **Not evaluated**; insufficient data exist upon which to base a health risk assessment.	Living and working areas located away from roadways, runways, and generators when possible.	Short-term: **Not evaluated**; insufficient data exist upon which to base a health risk assessment.
	Long-term: **Not evaluated**; insufficient data exist upon which to base a health risk assessment.		Long-term: **Not evaluated**; insufficient data exist upon which to base a health risk assessment.
Soil			
Soil exposures *(see paragraph 3)*	Short-term: **Not evaluated**. Short-term soil exposures do not typically pose a health risk. Consequently, no exposure guidelines exist.	Keep sleeves rolled down to limit skin contact. Wash hands frequently especially before eating. Shower after soil exposure to remove soil from skin.	Short-term: **Not evaluated.**
	Long-term: **None Identified.**		Long-term: **None identified.**
Water			
Water used for other purposes	Short-term: **None identified.**	Water supplied by host nation	Short-term: **None identified.**

Table 2: Population-Based Health Risk Estimates – Base Camp Jebel Ali, Dubai, UAE[1,2]

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented[5]	Residual Health Risk Estimate[4]
(See paragraph 4.2)	Long-term: **None identified.**	treated to water quality standards nearly identical to those of the U.S. Environmental Protection Agency	Long-term: **None identified.**
Consumed water (water used for drinking) *(See paragraph 4.3)*	Short-term: **Not Evaluated**; insufficient data exist upon which to base a health risk assessment.	Bottled water is procured from a U.S. Army Veterinary Corps approved source.	Short-term: **Not Evaluated**; insufficient data exist upon which to base a health risk assessment.
	Long-term: **Not Evaluated**; insufficient data exist upon which to base a health risk assessment.		Long-term: **Not Evaluated**; insufficient data exist upon which to base a health risk assessment.
Endemic Disease			
Gastrointestinal diseases *(See paragraph 6.2)*	Short-term: **Low.** Viral gastroenteritis can present at any time due to a high rate of personnel turnover, shared dining, berthing, bathroom facilities, and working spaces.	Standard Preventive Medicine measures: immunizations (hepatitis A and typhoid fever).	Short-term: **Low.** Based on disease incident reporting from Base Camp Jebel Ali, bacterial, protozoal, and hepatitis E infections present a low risk.
	Long-term: **Low**. Most gastrointestinal diseases do not cause prolonged illness.		Long-term: **Low** based on disease incident reporting from Base Camp Jebel Ali.
Arthropod vector-borne diseases *(See paragraph 6.3)*	Short-term: **Low.** Vectors present in the UAE (mosquitoes and sand flies) are capable of transmitting dengue fever, malaria, leishmaniasis, sandfly fever, and West Nile Fever. Malaria transmission has not been reported in the UAE since 1998 but imported cases in immigrants and expatriots occur. Risk of Malaria associated with imported cases is **low** in the UAE.	Standard preventive medicine measures: Properly wear insecticide-treated uniforms and apply insect repellent to the skin, chemoprophylaxis in accordance with combatant command (COCOM) policy (e.g., malaria), and remove vector harborages within the camp.	Short-term: **Low** based on disease incident reporting from Base Camp Jebel Ali.
	Long-term: **Low**. It is possible to be infected during deployment with leishmaniasis and not have clinically evident disease until redeployed.		Long-term: **Low** based on disease incident reporting from Base Camp Jebel Ali.
Water contact diseases *(See paragraph 6.4)*	Short-term: **Low**. Flooding after heavy rainfall facilitates the spread of leptospirosis already present in the soil.	Avoid fresh water sources, such as puddles/standing water, drainage areas, etc.	Short-term: **Low** based on disease incident reporting.

Table 2: Population-Based Health Risk Estimates – Base Camp Jebel Ali, Dubai, UAE[1,2]			
Source of Identified Health Risk[3]	**Unmitigated Health Risk Estimate[4]**	**Control Measures Implemented[5]**	**Residual Health Risk Estimate[4]**
	Long-term: **Low** based on disease incident reporting.		Long-term: **Low** based on disease incident reporting.
Respiratory diseases *(See paragraph 6.5)*	Short-term: **Moderate** for upper respiratory infections such as influenza. The high rate of personnel turnover, shared dining, berthing, recreational facilities, and working spaces allow for easy transmission. **Low** for tuberculosis and Middle East Respiratory Syndrome.	Influenza immunizations are given either before or during deployment. Local and third country national workers/contractors are required to complete health screening prior to employment. Potential tuberculosis exposure is addressed in the Post Deployment Health Assessment.	Short-term: **Low** for upper respiratory infections.
	Long-term: **Low.** Most respiratory diseases do not cause prolonged illness.		Long-term: **Low** based on disease incident reporting from Base Camp Jebel Ali.
Animal contact diseases *(See paragraph 6.6)*	Short-term: **Low.** Exposures to animals and/or locations where animals are kept (barnyards, slaughterhouses) are the primary infection sources for anthrax, Q-fever, and rabies.	Standard preventive medicine measures, as well as COCOM policy, generally prohibit contact with, adoption, or feeding of feral animals. Immunizations for anthrax and rabies (rabies vaccination and/or immune globulin given if clinically directed).	Short-term: **Low** based on disease incident reporting from Base Camp Jebel Ali.
	Long-term: **Low** based on disease incident reporting from Base Camp Jebel Ali.		Long-term: **Low** based on disease incident reporting from Base Camp Jebel Ali.
Venomous Animal/Insects			
Snakes, scorpions, and spiders *(See paragraph 7)*	Short-term: **Low.** If encountered, effects of venom vary with species from mild localized swelling (e.g., scorpion species) to potentially lethal (e.g., Horned Viper).	Standard preventive medicine measures, such as reducing harborages for these animals, as well as education on how to avoid them ("shake out boots before donning," etc.), reduce the risk of exposure.	Short-term: **Low.**
	Long-term: **None identified**.		Long-term: **None identified.**
Heat/Cold Stress			
Heat *(See paragraph 8)*	Short-term: **Moderate.** Moderate risk of heat injury in summer months for unacclimated personnel.	*Adequate periods of acclimation for newly reporting personnel.* *Work-rest cycles are adjusted based on monitoring - climatic conditions.*	Short-term: **Low.**
	Long-term: **Low.**		Long-term: **Low.**
Noise *(See paragraph 9)*	Short-term: **Low**.	Hearing protection is readily available and used.	Short-Term: **Low.**
	Long-term**: Moderate**		Long-term: **Low**

Table 2: Population-Based Health Risk Estimates – Base Camp Jebel Ali, UAE[1,2]

Footnotes:

[1] Table 2 provides a qualitative estimate of population-based short- and long-term health risks associated with the occupational environment conditions at Base Camp Jebel Ali. It does not represent an individual exposure profile. Actual individual exposures and health effects depend on many variables. For example, while a chemical may be present in the environment, if a person does not inhale, ingest, or contact a specific dose of the chemical for adequate duration and frequency, then there may be no health risk. Alternatively, a person at a specific location may experience a unique exposure, such as at the burn pit, which could result in a significant individual exposure. Any such person seeking medical care should have their specific conditions of exposure documented on Form SF600.

[2] This assessment is based on specific environmental sampling data and reports obtained from January 2012 through December 2015. 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] Table 2 is organized by major categories of identified sources of health risk. It only lists those sub-categories specifically identified and addressed at Base Camp Jebel Ali. The health risks are presented as Low, Moderate, High, or Extremely High for both acute and chronic health effects. The risk level is based on an assessment of both the potential severity of the health effects that could be caused and probability that exposure would occur at a level to produce such health effects. Details can be obtained from the Navy and Marine Corps Public Health Center (NMCPHC). When no risks of specific acute or chronic health effects were determined, sources were excluded. More detailed descriptions of OEH exposures that were evaluated but determined to pose no health risk are discussed in the following sections of this report.

[4] Risks in Table 2 are based on quantitative surveillance thresholds (e.g., review of disease surveillance data) or screening levels (e.g., Military Exposure Guidelines (MEGs) for chemicals). Some previous assessment reports may provide slightly inconsistent 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 few samples.

[5] 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 in place. 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.

1 Discussion of Health Risks at Base Camp Jebel Ali, UAE, by Source

The following sections provide additional information about the OEH conditions summarized in Table 1 and Table 2 above. All risk assessments were performed using the methodology described in the U.S. Army Public Health Command Technical Guide 230, *Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel* (USAPHC TG230). 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 having preventive measures in place. For environmental exposures related to airborne dust, there are limited preventive measures available, and those that are have little efficacy in reducing exposure to ambient conditions.

2 Air

2.1 Site-Specific Sources Identified

The combination of multiple air pollution sources, climatic conditions, and topographic features contribute to air quality degradation at Base Camp Jebel Ali.

- Dubai's hot, dry climate results in very dusty conditions during much of the year. During the summer months, low pressure systems develop over Saudi Arabia and create strong north-westerly winds, locally known as the Shamal. The Shamal stirs up the desert sands, reducing visibility and occasionally creating sandstorms that may last for days.
- The Dubai Aluminum Company (DUBAL) is located approximately 4 miles from Base Camp Jebel Ali. DUBAL's Jebel Ali operation consists of a 1 million ton per year smelter, a 2,350 megawatt power station and other facilities. The complex is one of the world's largest single-site primary aluminum smelters.
- An Emirates National Oil Company petroleum refinery is located less than a quarter mile from Base Camp Jebel Ali. The refinery processes condensate or light crude oil to yield refined products such as naphtha, jet fuel, diesel fuel, fuel oil, liquefied petroleum gas and various gasoline blending products.
- Star Energy Resources is located approximately one and a quarter miles from the base camp. Star Energy is a petroleum storage and transfer company. It has 33 above ground storage tanks with a combined storage capacity of more than 240 million gallons of refined petroleum product. It also has two berths for petroleum transfer to/from ships.

2.2 Particulate Matter

Particulate matter (PM) is a complex mixture of extremely small particles suspended in the air. 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. PM can include sand, soil, metals, volatile organic compounds, allergens, and other compounds, such as nitrates or sulfates that are formed by condensation or transformation of combustion exhaust. PM composition and particle size vary considerably depending on the source. Generally particulate matter of health concern is divided into two fractions: PM_{10} and $PM_{2.5}$. PM_{10} includes coarse particles with a diameter of 10 micrometers or less (0.0004 inches or one-seventh the width of a human hair). $PM_{2.5}$ includes fine particles less than 2.5 micron, 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 microns

2.3.1 Exposure Guidelines

Short-term (24-hour) PM_{10} (mg/m^3):
- Negligible MEG = 0.250
- Marginal MEG = 0.420
- Critical MEG = 0.600

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

2.3.2 Sample Data/Notes

From January 2012 to December 2015, 11 ambient 24 hour air PM_{10} samples were collected at Base Camp Jebel Ali. Results of analysis indicate that the airborne PM_{10} concentrations are routinely much higher than one would encounter in the United States. Data indicate that PM_{10} levels typically peak from June through September annually. This is consistent with summer conditions in the UAE when hot, gusty winds pick up sand and soil from the surrounding countryside.

2.3.3 Short-term (Acute) Health Risk

Approach: To assess acute risk associated with PM_{10}, the highest concentration detected during each calendar quarter, commonly referred to as the quarterly peak concentration, was used to arrive at acute risk estimates for Base Camp Jebel Ali. Peak concentrations ranged from a low of 0.0570 mg/m^3 to a high of 0.2581 mg/m^3. The risk estimate for the highest peak concentration is calculated first. If that risk is low, no further calculations are needed, as the acute risk for all periods is low. If the highest peak concentration yields a risk of moderate or higher, additional calculations are repeated on the next highest peaks until the risk characterization changes (e.g., risk changes from moderate to low).

Risk Assessment: The acute risk associated with PM_{10} exposure at the concentrations found at Base Camp Jebel Ali is **low**. There was no PM_{10} data collected prior to 2012, but the general consistency of PM_{10} concentrations seen in the existing data suggests that health risk for periods prior to the initiation of PM_{10} sampling would be similar.

Medical Implications: At the **low** risk level, a small number of individuals may experience eye, nose, and throat irritation and seek medical attention. In most individuals, the symptoms are mild and temporary, requiring no medical treatment. Individuals who sought medical treatment for those symptoms should have exposure/treatment noted in their medical record. Symptoms associated with exposure to PM_{10} would be expected to resolve after exposures ceased. Health effects may be exacerbated in persons with pre-existing health conditions (e.g., asthma or cardiopulmonary diseases).

Confidence in the Risk Assessment: Confidence in this risk assessment is low based on the relatively few samples available and the sporadic nature of sample collection.

2.3.4 Long-term (Chronic) Health Risk

Health Guidelines are not Defined for PM_{10}. 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 PM_{10} exposures.
Return to Table 2

2.4 Particulate Matter, less than 2.5 microns

2.4.1 Exposure Guidelines

Short-term (24-hour) $PM_{2.5}$ MEGs (mg/m^3):

- Negligible MEG = 0.065
- Marginal MEG = 0.250
- Critical MEG = 0.500

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

- Negligible MEG = 0.015
- Marginal MEG = 0.065.

2.4.2 Sample Data/Notes

Sampling for $PM_{2.5}$ started at Base Camp Jebel Ali in the third calendar quarter of 2013. From June 2013 to December 2015, 19 ambient 24 hour air samples were collected for $PM_{2.5}$. During data collection, approximately 37% (7 of 19 samples) results exceeded the 1year Negligible MEG for $PM_{2.5}$. Similar to PM_{10}, peak levels of $PM_{2.5}$ typically occur annually from June through September.

2.4.3 Short-term (Acute) Health Risk

Approach: To assess acute risk associated with $PM_{2.5}$, quarterly peak concentrations of $PM_{2.5}$ from October 2007 to December 2012 were used. Quarterly peak concentrations detected during this period ranged from 0.0536 mg/m^3 to 0.519 mg/m^3. Health risk associated with the highest peak concentration is calculated first. If the health risk associated with that concentration is low, no further calculations are conducted, as the acute risk for all periods is low. If the highest peak concentration yielded a risk of moderate or greater, additional calculations are repeated on the next highest peaks until the risk characterization changes (e.g., the risk estimate changed from moderate to low).

Risk Assessment: Overall, the acute health risk associated with $PM_{2.5}$ exposure at the concentrations found at Base Camp Jebel Ali is **low**; however, at least one 24 hour period was identified when acute health risk was elevated to **high**. That event occurred on December 12, 2015.

Medical Implications: At ambient dust concentrations, resulting in a low acute health risk, a small percentage of individuals may still experience health effects such as eye, nose, throat and lung irritation, including coughing, sneezing, runny nose, and shortness of breath. Some individuals might seek outpatient medical care, although most individuals would experience only mild effects at these levels of exposure. Symptoms would typically resolve when exposure ceases. During periods of high risk, more individuals may have been affected and the severity of symptoms increased. A small number of individuals may experience more pronounced effects such as decreased lung function and worsening of pre-existing medical conditions such as asthma. These more pronounced effects are unlikely from a single, short-term period of exposure.

Confidence in the Risk Assessment: Confidence in the risk assessment is low based on the limited $PM_{2.5}$ air sampling data available and inconsistency of sampling.

2.4.4 Long-term (Chronic) Health Risk

Approach: For chronic health risk, it was assumed that the longest deployment lasted 12 months and that camp residents were exposed to the same levels of dust 24 hours per day over the full term of their deployment. Thus, the exposure assumptions employed likely represent a worst-case exposure scenario. To assess chronic health risk associated with $PM_{2.5}$, annual average concentrations for $PM_{2.5}$ were calculated for each calendar year data was available. Health risk associated with the highest annual average concentration is calculated first. If that health risk estimate is low, no further calculations are needed, as the chronic health risk for all years is low. If the highest annual average concentration yielded a health risk estimate of moderate or higher, additional calculations are repeated

on the next highest annual averages until the risk characterization changes (e.g., the risk estimate changes from moderate to low). Annual average $PM_{2.5}$ concentrations for July 2013 through December 2015 ranged from 0.0608 mg/m^3 to 0.0969 mg/m^3. No $PM_{2.5}$ data exist prior to July of 2012.

Risk Assessment: The chronic health risk associated with $PM_{2.5}$ exposure for personnel at Base Camp Jebel Ali was **low** in 2013 and **moderate** for 2014 and 2015. Overall, the average $PM_{2.5}$ concentrations were reasonably similar from year to year, with the highest average concentration only slightly more than 1.5 times the lowest average concentration. Given the relative consistency of the data over the 3 years of sample collection, it is reasonable to infer that health risks associated with $PM_{2.5}$ for periods before data collection began would be similar.

Medical Implications: Repeated, long-term exposure to the airborne concentrations of $PM_{2.5}$ that are routinely present at Base Camp Jebel Ali may increase the probability of chronic health conditions in generally healthy U.S. Service members over their lifetime. These conditions include reduced lung function, chronic bronchitis, chronic obstructive pulmonary disease (COPD), asthma, and certain cardiopulmonary diseases. For those with a history of asthma or pre-existing cardiopulmonary disease, there is higher risk for exacerbating those pre-existing conditions.

Confidence in the Risk Assessment: Confidence in the risk assessment is **low** based on the limited $PM_{2.5}$ air sampling data available and inconsistency of sampling.
Return to Table 1
Return to Table 2

2.5 Airborne Metals

2.5.1 Sample Data/Notes

From January 2012 to December 2015, metals analysis was performed on 30 ambient air samples collected at Base Camp Jebel Ali.

2.5.2 Short-term (Acute) Health Risk

Approach: For screening purposes, all airborne metals detected from particulate matter sampling were compared to their corresponding 1 year Negligible MEGs. Metals without a single detection above that MEG were removed from further consideration. None of the metals detected from particulate matter sampling exceeded their respective 1 year Negligible MEGs.

Risk Assessment: Airborne metals are **not a source of acute health risk** based on available data.

Medical Implications: None identified.

Confidence in the Risk Assessment: Based on the limited data available, confidence in this risk assessment is low.

2.5.3 Long-term (Chronic) Health Risk

Approach: Annual average concentrations of airborne metals detected are used to assess the long-term risk associated with potential long-term exposures. When calculating the average concentration, a surrogate value of half the laboratory limit of quantitation for that metal is used for each sample where the specific metal is not detected. For screening purposes, all airborne metals detected are first compared to their corresponding 1 year Negligible MEGs. Metals without a single detection above that MEG are removed from further consideration. None of the metals detected from particulate matter sampling exceeded their respective 1 year Negligible MEGs.

Risk Assessment: Airborne metals are **not a source of chronic health risk** based on available data.

Medical Implications: None identified.

Confidence in the Risk Assessment: Based on the available data, confidence in this risk assessment is low.
Return to Table 2

2.6 Volatile Organic Compounds

Volatile organic compounds (VOCs) are carbon-based chemicals that easily evaporate under normal atmospheric conditions. They can be naturally occurring or man-made. Man-made VOCs are emitted by a wide array of products that number in the thousands. Examples include paints, lacquers, paint strippers, industrial solvents, household cleaners, pesticides, building materials and furnishings, fuels and fuel combustion, and cigarette smoke. Most of the VOCs detected at Base Camp Jebel Ali are associated with fuels and/or fuel combustion.

There are several sources of ambient VOCs at Base Camp Jebel Ali, including motor vehicles, onsite electric power generation, offsite oil refining, petroleum storage, shore to ship transfer of refined petroleum products and routine maintenance operations on U.S. Navy maritime patrol craft.

2.6.1 Sample Data/Notes:

From January 2012 through December 2015 only 3 air samples were collected for VOC analysis. All samples were collected in September 2015.

2.6.2 Short-term (Acute) Health Risk

Approach: For screening purposes, all compounds detected were first compared to their corresponding 1 year Negligible MEGs. Compounds without a single detection above that MEG were removed from further consideration. Only acrolein was present at concentrations above its 1 year Negligible MEG value of 0.00014 mg/m^3. Acrolein was detected at concentrations greater than its 1 year Negligible MEG in all 3 samples taken in September. Concentrations of acrolein detected in September 2015 ranged from 0.0014 mg/m^3 to 0.0069 mg/m^3 with an average concentration of 0.0034 mg/m^3. The peak concentration of acrolein was used to assess the short-term health risk associated with potential exposures. Risk estimates for the highest peak were calculated first. As with other airborne compounds, if the highest peak concentration yielded a risk estimate of low, no further calculations were deemed necessary.

Risk Assessment: Based on the available data, **no short-term health risk** associated with potential VOC exposures was identified during September 2015. There are insufficient data upon which to base health risk assessments for other periods at Base Camp Jebel Ali.

Medical Implications: Fuel combustion is the primary source of acrolein release to the atmosphere. Acrolein has a very disagreeable odor and breaks down rapidly in the air by reacting with other chemicals and sunlight. Most individuals can smell acrolein at a concentration of approximately 0.6 mg/m^3. Breathing small amounts of acrolein can cause watering of the eyes, burning of the nose and throat, and decreased breathing rate. These symptoms go away when exposure stops. Studies indicate that very slight eye irritation and annoyance/discomfort begin at about 0.2 mg/m^3, and nose/throat irritation and a decrease in respiratory rate at approximately 0.7 mg/m^3. Concentrations of acrolein detected at Base Camp Jebel Ali were well below the threshold concentrations known to cause irritation, thus no health effects associated with short-term acrolein exposure would be identified.

Confidence in the Risk Assessment: Confidence in this risk assessment is low. Only 3 VOC samples exist, which were obtained during a single sampling event in September 2015. Since existing data are not available to quantify the variability of VOC concentrations typically expected over a 12 month climatic cycle, the health risk may over or understated.

2.6.3 Long-term (Chronic) Health Risk

Not evaluated; insufficient data exist upon which to base a health risk assessment.
Return to Table 2

2.7 Semi-Volatile Organic Compounds

Semi-volatile organic compounds (SVOCs) are compounds in ambient air formed during combustion; they are also present in the unburned portion of gasoline, diesel fuel, lubricating oils, wood, refuse, and other organic substances. Semi-volatile organic compounds include polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCBs), dioxin, and furans. They can be found in the air in minute concentrations everywhere, even the Antarctic. Semi-volatile organic compounds are present in air as vapors or adsorbed to the surface of small solid particles. Semi-volatile organic compounds in ambient air generally occur as complex mixtures rather than a single compound. There are several sources of SVOCs on and around Base Camp Jebel Ali, including electric power generators, motor vehicle exhaust, commercial shipping, and U.S. Navy maritime patrol craft.

2.7.1 Sample Data/Notes

In September 2015, Navy Environmental and Preventive Medicine Unit No 2 employed a real-time photoelectric aerosol sensor capable of measuring total ambient particulate-bound PAH concentrations at Base Camp Jebel Ali. Less than 1 day of continuous sampling data conducted on September 8, 2015 yielded 189 data points from a single sampling location selected to represent where camp residents live, work, and recreate. Concentrations of particle bound PAH compounds ranged from 0.0004 micrograms/cubic meter (µg/m^3) to 0.2410 µg/m^3 with an average concentration of approximately 0.0364 µg/m^3. No military exposure guidelines or EPA risk-based screening levels currently exist for inhalation of total PAH compounds. Accordingly, health risk values for benzo(a)pyrene (the PAH with the highest potential for health impacts) published by the California Air Resources Board were used for health risk screening purposes. The California Air Resources Board risk-based concentrations assume lifetime residential exposures (70 years) whereas exposures at Base Camp Jebel Ali are typically 1 year or less. In addition, benzo(a)pyrene typically comprises less than five percent of the total amount of PAHs present in the atmosphere. To ensure a health protective assessment, all PAHs detected at the base camp were assumed to be benzo(a)pyrene. Total particle bound concentrations of PAH detected in the limited sampling data available were all well below this health protective screening value during the sampling period.

2.7.2 Short-term (Acute) Health Risk

Not evaluated; insufficient data exist upon which to base a health risk assessment.

2.7.3 Long-term (Chronic) Health Risk

Not evaluated; insufficient data exist upon which to base a health risk assessment.
Return to Table 2

2.8 Diesel Exhaust

Diesel exhaust is a complex mixture of gases, including oxides of nitrogen (NO and NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), carbon dioxide (CO_2), ozone, and diesel particulate matter. Diesel particulate matter consists of small solid particles formed by the incomplete burning of fuel in a diesel engine. Diesel particulate matter is composed of a solid core of elemental carbon with other substances such as inorganic carbon, metals ash, sulfates, and silicates attached to the surface. The primary source of diesel exhaust at Base Camp Jebel Ali is from electricity generation by commercial and tactical generators. The gaseous components may also be generated by other combustion sources, including the commercial ship traffic, tactical vehicles and U.S. Navy maritime patrol craft.

2.8.1 Sample Data/Notes

Continuous sampling for CO, SO_2 and NO_2 was conducted on 11, 12 and 14 September, 2015. The concentrations of the 3 gaseous components of diesel exhaust, for which a sampling method was available during the 3 days of sampling, were as follows; NO_2, none detected; SO_2, none detected and CO, none detected to 4.6 mg/m^3. All concentrations detected were less than their respective 1 year Negligible MEG during the sampling period.

2.8.2 Short-term (Acute) Risk

Not evaluated; insufficient data exist upon which to base a health risk assessment.

2.8.3 Long-term (Chronic) Health Risk

Not evaluated; insufficient data exist upon which to base a health risk assessment.
Return to Table 2

3 Soil

3.1 Surface Soil

3.1.1 Sample Data/Notes

From January 2010 to December 2015, 5 surface soil samples were collected. According to field data sheets, the soil samples were collected from areas and/or activities where the potential for soil exposure was the greatest. Laboratory analysis of soil samples includes SVOCs, heavy metals, pesticides, herbicides, and radionuclides. The primary exposure pathways associated with soil are dermal contact and incidental ingestion. The 2014 Occupational and Environmental Site Assessment for Base Camp Jebel Ali reports that the entire site is covered by concrete pavers, thus limiting the potential for soil exposures.

3.1.2 Short-term (Acute) Health Risk

Not evaluated. Exposure to soils does not generally pose short-term health risk. Consequently, no MEGs for short-term exposure to soils exist, and sampling data for soils are not evaluated for acute health risks**.**

3.1.3 Long-term (Chronic) Health Risk

Approach: For screening purposes, all compounds detected in the soil samples were compared to their corresponding 1 year Negligible MEGs. Compounds without a single detection above that MEG

were removed from further consideration. None of the compounds detected exceeded their respective 1 year Negligible MEGs.

Risk Assessment: Based on available data, surface soil is **not a source of health risk** at Base Camp Jebel Ali.

Medical Implications: None identified.

Confidence in the Risk Assessment: Confidence in the risk assessment is high despite the low number of samples. Since the ground's surface is entirely covered by concrete pavers, there is very limited potential for soil exposures.
Return to Table 2

4 Water

4.1 Site-Specific Sources Identified

Two sources of water are available at Base Camp Jebel Ali; bottled water from U.S. Army Veterinary Corps approved commercial vendors and municipal water from the City of Jebel Ali. Bottled water is supplied for drinking and the municipal water is used for all other purposes (e.g., cooking and personal hygiene).

4.2 Water for Other Purposes (Non-Drinking Water)

4.2.1 Sample Data/Notes

Enhanced water surveillance, which includes chemical analysis, typically occurs at 6 month intervals during military operations. Only 5 samples of Jebel Ali municipal water were submitted for analysis. One sample from August 2102, two samples from August 2014, one sample from September 2015 and one sample from August 2008. No municipal water quality data exist for 2013.

To assess the health risk associated with the use of municipally treated water at Base Camp Jebel Ali, the following assumptions were made:

- Jebel Ali municipal water is supplied primarily for cooking and personal hygiene.
- Deployments last a maximum of 12 months.
- The primary routes of exposure associated with Jebel Ali municipal water are incidental ingestion through cooking and personal hygiene (i.e., brushing teeth/oral hygiene).
- Camp residents ingest far less than 2 L (i.e., food preparation) of Jebel Ali municipal water per day.

4.2.2 Short-term (Acute) Health Risk

Approach: For screening purposes, any compound with a peak concentration less than or equal to 2.5 times the 14 day Negligible MEG for consuming 5 L/day is eliminated from further consideration. If a 14 day, 5 L/day Negligible MEG is not available, the more conservative 1 year, 5 L/day Negligible MEG is used for screening purposes. The 2.5 multiplier adjusts the 5 L/day MEG to a consumption rate of 2 L/day, which is equivalent to the consumption rate upon which the EPA Maximum Contaminant Levels (MCL) are established. This still provides a significant level of health protection when the primary route of exposure of non-drinking water is skin contact and incidental ingestion, and when one considers that EPA MCL are based on 30 years of consumption data.

Risk Assessment: **No short-term health risk** associated with the use of municipal water for cooking, showering, hand washing and cleaning was identified.

Medical Implications: None identified based on the available sampling data.

Confidence in the Risk Assessment: Regardless of the low number of samples in the data set, confidence in this risk assessment is medium based on the drinking water quality standards in the UAE, which are very similar to those of the EPA.

4.2.3 Long-term (Chronic) Health Risk

Approach: The average concentration of each analyte detected in all samples taken over a calendar year is used to estimate chronic health risk. If only a single sample was obtained during a calendar year, the concentrations detected in that sample are used and assumed to remain unchanged until a follow-on sample indicates changes in chemical concentrations. When calculating the average concentration, a surrogate value of half the laboratory limit of quantitation is used for each sample when a specific analyte is not detected. For screening purposes, any compound with a peak concentration less than or equal to 2.5 times the 14 day Negligible MEG for consuming 5 L/day is eliminated from further consideration. If a 14 day, 5 L/day Negligible MEG is not available, the more conservative 1 year, 5 L/day Negligible is used for screening purposes.

Risk Assessment: **No long-term health risk** associated with the use of municipally treated water for cooking, showering, hand washing and cleaning was identified at Base Camp Jebel Ali.

Medical Implications: None identified.

Confidence in the Risk Assessment: Regardless of the low number of samples in the data set, confidence in this risk assessment is medium based on the drinking water quality standards in the UAE, which are very similar to those of the EPA.
Return to Table 2

4.3 Consumed Water (Bottled Water)

4.3.1 Sample Data/Notes

Bottled drinking water has been purchased for consumption at Base Camp Jebel Ali from suppliers approved by the U.S. Army Veterinary Corps since the camp was first occupied by the U.S. Navy. Only 1 sample exists for bottled water consumed at Base Camp Jebel Ali. That sample was submitted in August 2014. None of the analytes detected in the single bottled water sample available for Base Camp Jebel Ali exceeded its respective MEG screening value.

4.3.2 Short-term (Acute) Health Risk

Not evaluated; insufficient data exist upon which to base a health risk assessment.

4.3.3 Long-term (Chronic) Health Risk

Not evaluated; insufficient data exist upon which to base a health risk assessment.
Return to Table 2

5 Military Unique

5.1 Chemical Biological, Radiological Nuclear (CBRN) Weapons

There were no specific hazard sources or exposure incidents are documented in the Defense Occupational and Environmental Health Readiness System (DOEHRS) or the Military Exposure Surveillance Library (MESL) during the period January 2012 through December 2015.

5.1.1 Short-term (Acute) and Long-term (Chronic) Health Risks

Not evaluated. No data were available upon which to base a health risk assessment.

5.2 Depleted Uranium (DU)

There were no specific hazard sources or exposure incidents are documented in DOEHRS or MESL during the period January 2012 through December 2015.

5.2.1 Short-term (Acute) and Long-term (Chronic) Health Risks

Not evaluated. No data were available upon which to base a health risk assessment.

5.3 Ionizing Radiation

No specific hazard sources or exposure incidents are documented in DOEHRS or MESL from the January 2012 through December 2015.

5.3.1 Short-term (Acute) and Long-term (Chronic) Health Risks

Not evaluated. No data were available upon which to base a health risk assessment.

5.4 Non-Ionizing Radiation

There were no specific hazard sources or exposure incidents are documented in DOEHRS or MESL during the period January 2012 through December 2015.

5.4.1 Short-term (Acute) and Long-term (Chronic) Health Risks

Not evaluated. No data were available upon which to base a health risk assessment.
Return to Table 2

6 Endemic Diseases

6.1 Sample Data/Notes

Assessed risk is the residual risk that exists in the presence of preventive measures.

- Department of Defense Directive 6490.02 series, Comprehensive Health Surveillance, establishes policy for routine health surveillance of all DOD personnel throughout their military service.
- The Disease Reporting System internet (DRSi) collects and maintains archives of Medical Event Reports (MERs) for all Services.

- Endemic diseases present in the UAE were identified using the "Destinations" section of the Centers for Disease Control and Prevention (CDC) Travelers' Health website, **http://wwwnc.cdc.gov/travel/destinations/clinician/none/united-arab-emirates**
- Additional health information was identified based on the World Health Organization (WHO) UAE Country Profile **http://www.who.int/gho/countries/are/en/**.
- Where effective vaccines, such as those for Hepatitis A and B, are in place, risk to individuals is effectively reduced to none and these endemic diseases were excluded from further assessment.
- Actual disease prevalence in the local population is unknown due to lack of access to surveillance data in the host nation.
- Overall, few disease reports associated with Base Camp Jebel Ali were identified. Disease reports associated with exposure at Base Camp Jebel Ali or reported by any UAE command were for routinely identified diseases that do not have ongoing or severe outcomes.

6.2 Gastrointestinal Diseases

Typhoid fever and Hepatitis A may pose a risk to travelers in the UAE, especially those visiting smaller cities or rural areas. U.S. Service members are routinely vaccinated against these diseases. Viral gastroenteritis, which is spread through contact or fomites (any inanimate object or substance capable of carrying infectious organisms), presents a recurrent risk at Base Camp Jebel Ali.

6.2.1 Short-term (Acute) Health Risks

Approach: The health risk for fomite-borne gastrointestinal infections and endemic food and waterborne diseases to individuals deployed to Base Camp Jebel Ali during the period of this assessment was epidemiologically assessed based on the combination of identified endemic diseases, knowledge of preventive measures in place, review of medical event reports associated with deployment to Base Camp Jebel Ali, and direct communication with military public health personnel.

Risk Assessment:

- The short-term risk for viral gastroenteritis is **low.** Risk due to a high rate of personnel turnover, shared dining halls, berthing spaces, bathing facilities, and working spaces, which are not substantially different than those found in similar settings within the United States.
- The short-term risk associated with food borne and waterborne diseases (i.e., bacterial or viral gastroenteritis, protozoal diarrhea, cholera, brucellosis, hepatitis E) at Base Camp Jebel Ali is **low**.

Medical Implications: Gastroenteritis, particularly from viral agents, can cause periodic outbreaks despite preventive measures. A small number of infections may require greater than 72 hours convalescence and/or hospitalization.

Confidence in the Risk Assessment: Confidence in the risk assessment is medium. Food and water borne diseases, especially those with short convalescence and lack of long-term health effects are often underreported for deployed U.S. service members.

6.2.2 Long-term (Chronic) Health Risks

Approach: Application of the same approach referenced in Section 6.2.1 above.

Risk Assessment: The long-term risk associated with food and waterborne diseases is **low** for protozoal diarrhea and brucellosis.

Medical Implications: Long-term health effects resulting from infection with food and waterborne diseases are rare.

Confidence in the Risk Assessment: Confidence in the risk assessment is high.
Return to Table 2

6.3 Arthropod Vector-Borne Diseases

The climate and ecological habitat found in the UAE support populations of arthropod vectors, including mosquitoes and sand flies capable of transmitting dengue fever, malaria, leishmaniasis, sand-fly fever, and West Nile Fever. Significant reduction in arthropod vectors as a result of malaria prevention efforts has dramatically reduced arthropod borne disease transmission in the local population. Malaria transmission has not been reported in the UAE since 1998, but imported cases exist. Risk of dengue fever is higher in urban and other densely populated areas. Removing vector harborages and spraying for vectors within Base Camp Jebel Ali, as well as properly wearing insecticide-treated uniforms and applying insect repellent to the skin, are the main protective measures against vector-borne diseases.

6.3.1 Short-term (Acute) Health Risks

Approach: The health risk for endemic vector-borne diseases to individuals deployed to Base Camp Jebel Ali during the period of this assessment was epidemiologically assessed based on the combination of identified endemic diseases, knowledge of preventive measures in place, reviewing MERs associated with Base Camp Jebel Ali deployment, and directly communicating with military public health personnel stationed at Base Camp Jebel Ali.

Risk Assessment: The short-term risk for the vector-borne diseases dengue fever, malaria, leishmaniasis (both visceral and cutaneous), sand-fly fever, and West Nile fever is **low**. Individuals who forward deploy from Base Camp Jebel Ali to outlying areas may experience increased short-term risk.

Medical Implications: Dengue fever, malaria, cutaneous leishmaniasis, sand-fly fever, and West Nile fever have short incubation periods ranging from days to weeks. Any of these diseases would initially present as acute fever and malaise, some are accompanied by rash, and would lead to acute, sometimes severe illness.

Confidence in the Risk Assessment: Confidence in the risk assessment is high. WHO health statistics indicate low incidence of vector borne disease in the local UAE population; no vector-borne disease reports for individuals who resided within Base Camp Jebel Ali were identified.

6.3.2 Long-term (Chronic) Health Risks

Approach: Application of the same approach referenced in Section 6.3.1 above.

Risk Assessment: The long-term risk for leishmaniasis, dengue fever and sand-fly fever is **low**.

Medical Implications: Both visceral and cutaneous leishmaniasis may have extended incubation periods, ranging from a week to years. Although rare, it is possible to be infected during deployment, but not to have clinically evident disease until redeployed. Leishmaniasis should be considered in the differential diagnosis for any unusual skin lesions or chronic, systemic disease.

Certain vector-borne diseases have the potential to cause long-term health effects; individual history of infection with a vector borne disease should be considered when evaluating patients with chronic symptoms such as prolonged fatigue, depression, arthralgia or myalgia.

Confidence in the Risk Assessment: Confidence in the risk assessment is high. Incidence of leishmaniasis, particularly visceral, in the post-deployment military population is known to be extremely low.
Return to Table 2

6.4 Water Contact Diseases

Operations or activities that involve extensive freshwater contact may result in individuals being exposed to leptospirosis. The occurrence of flooding after heavy rainfall facilitates the spread of leptospirosis because, as water saturates the environment, *Leptospira* bacteria present in the soil pass directly into surface waters. Activities such as wading or swimming in freshwater sources may result in exposures to enteric diseases such as diarrhea and hepatitis via incidental ingestion of water. Prolonged water contact also may lead to the development of a variety of skin conditions, such as bacterial or fungal dermatitis. Elimination of standing and/or open bodies of fresh water protects against the spread of water contact diseases.

6.4.1 Short-term (Acute) Health Risks

Approach: The health risk for endemic water-contact diseases to individuals deployed to Base Camp Jebel Ali during the period of this assessment was epidemiologically assessed based on identifying endemic diseases, knowledge of preventive measures in place, reviewing MERs associated with deployment to Base Camp Jebel Ali, and directly communicating with military public health personnel stationed at Base Camp Jebel Ali.

Risk Assessment: The short-term risk for leptospirosis is **low**.

Medical Implications: Leptospirosis, which has an incubation period of 5–14 days, presents as acute fever with nonspecific symptoms that last for a few days to 3 weeks or longer.

Confidence in the Risk Assessment: Confidence in the risk assessment is high. No reported cases of water contact diseases were identified during the assessment period.

6.4.2 Long-term (Chronic) Health Risks

Approach: Application of the same approach referenced in Section 6.4.1 above.

Risk Assessment: **No long-term risk** for leptospirosis was identified.

Medical Implications: None identified.

Confidence in the Risk Assessment: Confidence in risk assessment is high.
Return to Table 2

6.5 Respiratory Diseases

U.S. Service members living and working in close-quarter conditions are at risk for substantial person-to-person spread of upper respiratory infections, such as the common cold and influenza. Primary exposure pathways for tuberculosis are prolonged close contact (generally several hours per day for greater than 3 days/week in a closed space) with the local population or third country national contractors.

6.5.1 Short-term (Acute) Health Risks

Approach: The health risk for respiratory diseases to individuals deployed to Base Camp Jebel Ali during the period of this assessment was epidemiologically assessed based on identifying endemic diseases, knowledge of preventive measures in place, reviewing the incidence of MERs in the host nation and associated with deployment to Base Camp Jebel Ali, and directly communicating with military public health personnel.

Risk Assessment:

- The short-term risk for upper respiratory infections is **low**. Risk due to a high rate of personnel turnover, shared dining halls, berthing spaces, bathing and recreational facilities, and working spaces, which are not substantially different than those found in similar settings within the United States.
- The short-term risk for tuberculosis is **low**.
- The short-term risk for MERS is **low**.

Medical Implications:

- Upper respiratory infections, particularly from viral agents, can cause periodic outbreaks in spite of preventive measures. A small proportion of infections may require greater than 72 hours convalescence and/or hospitalization
- **Tuberculosis**: Symptoms of tuberculosis, including fever, weight loss, night sweats and cough, typically start within 1-6 months of infection. The lifetime risk for tuberculosis disease after becoming infected is 5-10%; half of this risk occurs in the first two years following infection.
- **MERS**: MERS is a viral respiratory illness first reported in Saudi Arabia in 2012. Symptoms of MERS include fever, cough, and shortness of breath. The incubation period is typically 2-14 day.

Confidence in the Risk Assessment: Confidence in risk assessment is medium. Upper respiratory infections, especially those with short convalescence and lack of long-term health effects are not reportable for deployed military populations. WHO health statistics indicate low incidence of tuberculosis in the local UAE population; no reports of tuberculosis were identified for individuals at Base Camp Jebel Ali during the assessment period.

6.5.2 Long-term (Chronic) Health Risks

Approach: Application of the same approach referenced in Section 6.5.1 above.

Risk Assessment: The long-term risk for tuberculosis and MERS is **low**.

Medical Implications:

- **Tuberculosis:** Symptoms of tuberculosis can be delayed by two or more years following infection. Tuberculosis should be considered in assessing symptoms of fever accompanied by night sweats and cough.
- **MERS**: MERS should be included in the differential diagnosis for any patient with a history of travel from countries in or near the Arabian Peninsula within 14 days before symptom onset, or close contact with a symptomatic traveler who developed fever and acute respiratory illness

(not necessarily pneumonia) within 14 days after traveling from countries in or near the Arabian Peninsula.

Confidence in the Risk Assessment: Confidence in risk assessment is high. WHO health statistics indicate low incidence of tuberculosis in the local UAE population; prevalence of tuberculosis in the post deployment military population is known to be extremely low.
Return to Table 2

6.6 Animal-Contact Diseases

The UAE requires all domesticated cats and dogs to be vaccinated against rabies; however, animal rabies still occurs in wild animal populations with foxes and sporadically in stray dogs. No recently reported cases of rabies occurring in humans identified. Anthrax, while not prevalent, has been reported in domestic animals in some parts of the UAE. Q-fever was found in a rare species of Gazelle (in a private collection in Dubai as late as 2007) and reported in racing camels in Abu Dhabi. Serologic evidence suggests the presence of Q-fever in humans throughout the Arabian Peninsula.

6.6.1 Short-term (Acute) Health Risks

Approach: The health risk for endemic animal contact diseases to individuals deployed to Base Camp Jebel Ali during the period of this assessment was epidemiologically assessed based on the combination of identified endemic diseases, knowledge of preventive measures in place, review of medical event reports associated with deployment to Base Camp Jebel Ali, and direct communication with military public health personnel.

Risk Assessment: The short-term risk for rabies, Q-fever and anthrax is **low**.

Medical Implications:

- **Rabies**: All unprovoked dog or wild animal bites should be medically evaluated for possible post-exposure rabies treatment.
- **Q-fever**: Acute Q fever is usually a nonspecific febrile illness, often with atypical pneumonia or transient hepatitis. Sero-conversion without symptoms is common. As a rule, Q-fever is self-limiting and resolves without treatment, but some untreated cases may progress to chronic Q-fever (e.g., endocarditis, granulomatous hepatitis, osteomyelitis, interstitial pulmonary fibrosis).

Confidence in the Risk Assessment: Confidence in risk assessment is high. No reports of any animal contact diseases were identified during the risk assessment period.

6.6.2 Long-term (Chronic) Health Risks

Approach: Application of the same approach referenced in Section 6.6.1 above.

Risk Assessment: The long-term risk for rabies, Q-fever and anthrax is **low**.

Medical Implications: None identified.

Confidence in the Risk Assessment: Confidence in risk assessment is high. While actual disease prevalence in the local animal population is unknown, the incidence of animal contact diseases in the post deployment military population is known to be extremely low.
Return to Table 2

7 Venomous Animals/Insects

The species listed below have home ranges that overlap the location of Base Camp Jebel Ali, and may present a health risk if they are encountered.

7.1 Short-term (Acute) Health Risks

Approach: The following information was obtained from Clinical Toxinology Resources via **http://www.toxinology.com/index.cfm**. The search consisted of looking for animals and/or insects present in the UAE and/or specifically in Dubai. The following list should not be considered inclusive; other venomous scorpions and snakes may be present in the region. See Section 10 for more information about pesticides and pest control measures.

Risk Assessment:

- Spiders: There are no venomous spiders native to the UAE. However, it has been reported that Red-back spiders (*Latrodectus hasselti*) have been imported from Australia. The bite of the Red-back spider can cause serious illness and has even caused deaths. Red-back Spiders rarely leave their webs; therefore, humans are not likely to be bitten unless a body part such as a hand is put directly into the web. Due to the nature of their small jaws, many bites are ineffective. In the event of a successful bite, the venom acts directly on the nerves, resulting in release and subsequent depletion of neurotransmitters. Common early symptoms are pain (which can become severe), sweating (to include local sweating at the bite site), muscular weakness, nausea and vomiting. The health risk associated with spiders is **low**.
- Scorpions: Numerous species of scorpion, such as *Androctonus crassicauda, Hemisscorpius arabicus* and *Hottentotta jayakari,* are found in the UAE. Of these, only the sting of *Androctonus crassicauda*, the Black Scorpion, has the potential for clinical significance. UAE native scorpion stings commonly cause short-lived local effects, such as pain at the sting location, in normally healthy adults. The health risk associated with scorpions is **low**.
- Terrestrial Snakes: Numerous venomous terrestrial snake species are found in the UAE. The following species are known to be present and may pose a health risk, if encountered:

Cerastes cerastes	Horned Viper
Echis omanensis	Oman Saw-scaled Viper
Pseudocerastes persicus	Persian Horned Viper
Cerastes gasperettii	Gasperetti's Horned Viper
Echis sochureki	Sochurek's Saw-scaled Viper
Walterinnesia morgani	Black Desert Cobra

  Bites associated with all the snakes species listed above are severe, with both local tissue damage and paralysis. The health risk associated with the bite of these snakes is high, but potential for encounters is low. Overall, the health risk associated with terrestrial snakes is **low**.
- Sea Snakes: Venomous sea snakes are plentiful in the waters of the Arabian Gulf. The below list of species are known to be present and may pose a health risk, if encountered: *Hydrophis cyanocinctus, Pelamus platurus, Astrotia stokesii, Enhydrina schistose, Hydrophis gracilis, Hydrophis lapemoides Hydrophis ornatus, Hydrophis spiralis, Hydrophis viperina, and Lapemus curtus*. Most sea snakes fear humans and flee when encountered. The health risk associated with sea snakes is **low**.

Medical Implications: None identified.

Confidence in the Risk Assessment: Confidence in risk assessment is high.

7.2 Long-term (Chronic) Health Risks

Approach: Application of the same approach referenced in Section 7.2 above.

Risk Assessment: The chronic health risk associated with venomous animals and insects is **low**.

Medical Implications: None identified.

Confidence in the Risk Assessment: Confidence in risk assessment is high.
Return to Table 2

8 Heat/Cold Stress

8.1 Site-Specific Conditions

Dubai weather is characterized by a tropical desert climate with hot, sunny conditions. Summer months (from April to December) are very hot and with temperatures climbing to 104°F or higher and rarely dropping below 86°F. Coastal humidity exceeds 85% most of the summer. Winter months (from December to March) are warm with average highs of around 73°F and lows of around 57°F.

8.2 Heat

8.2.1 Heat Exposure Guidelines

In accordance with military doctrine, heat advisory conditions are typically communicated to the camp population by displaying color-coded flags based on Wet Bulb Globe Temperature (WBGT) measurements. WBGT measurements are a composite temperature used to estimate the effect of temperature, humidity, wind speed, and solar radiation on individuals. The WBGT reading drives preventive measures, such as adjusting work/rest cycles and limiting outdoor activities, to reduce the risk of heat injury. The range of WBGT measurements and their corresponding color-coded flags are, as follows:

- Less than 80 White
- 80 – 84.9 Green
- 85 – 87.9 Yellow (Amber)
- 88 – 89.9 Red
- 90 or above Black

8.2.2 Sample Data/Notes

No information on heat stress control program at Base Camp Jebel Ali exists.

8.2.3 Short-term (Acute) and Long-term (Chronic) Health Risk

Approach: No heat casualty, medical event reports involving heat injuries or heat stress monitoring data were available in the DOEHRS or MESL for Base Camp Jebel Ali. Risk estimates are based strictly on climatologic data.

Risk Assessment:

- The short-term health risk of heat injury for unacclimated individuals (i.e., on site less than four weeks) and those with underlying health conditions is **moderate**. For all other individuals, the risk is **low**.
- The long-term health risk is l**ow.**

Medical Implications: Severity of heat illness can range from mild clinical signs such as clamminess, nausea, disorientation, or headache to life-threatening symptoms requiring hospitalization. Long-term medical implications from heat injuries are rare but can occur, especially with more serious injuries such as heat stroke. Individuals with a history of heat injury, even when medical attention was not sought, are at increased risk for future heat injury; repeat heat injury may have increased severity.

Confidence in the Risk Assessment: Based on generally available information on climatic conditions and military heat stress prevention programs, the confidence in risk assessment is high. Individuals who experienced mild symptoms of heat illness may not have sought medical attention; this may lead to an underestimation of the risk.
Return to Table 1
Return to Table 2

8.3 Cold

8.3.1 Short (Acute) and Long-term (Chronic) Health Risk

Approach: No cold casualty, medical event reports involving cold injuries or cold stress monitoring data were available in the DOEHRS or MESL for Base Camp Jebel Ali. Risk estimates are based strictly on climatologic data.

Risk Assessment: **None identified** due to Dubai's climate comprised of a very hot summer and a relatively warm winter.

Medical Implications: None identified.

Confidence in the Risk Assessment: Based on available information on climatic conditions, the confidence in risk assessment is high.

9 Noise

9.1 Continuous

9.1.1 Exposure Guidelines

The Services have established occupational exposure limits (OEL) for continuous or intermittent noise at 85 decibels on the A-weighted scale (dbA) focused on occupational noise exposures and the prevention of noise-induced hearing loss. These standards may be adjusted for longer work shifts, up to a maximum of 16 hours (see table below). A minimum 8 hour recovery time is required between shifts.

8 Hour	12 Hour	16 Hour
85	82.375	82

9.1.2 Site-Specific Conditions

Sources of potential noise at Base Camp Jebel Ali include individual commercial and tactical generators, motor vehicles, and use of hand tools when performing routine maintenance operations of patrol craft. The standard work shift is 8 to12 hours, after which personnel return to their contracted living quarters within the City of Jebel Ali. Thus, there is a full recovery period for Base Camp Jebel Ali personnel after noise exposure.

9.1.3 Sample Data/Notes

No occupational noise exposure data exists for Base Camp Jebel Ali.

9.1.4 Short (Acute) and Long-term (Chronic) Health Risk

Approach: Knowledge of the Service hearing conservation programs and typical sound pressure level measurements associated with the various potential noise generating sources were used to complete the health risk assessment.

Risk Assessment:

- The short-term risk of noise induced hearing loss with the use of appropriate hearing protection use was **low**. Few exposed individuals are expected to have experienced noticeable short-term health effects such as annoyance, speech interference, fatigue and temporary hearing threshold shifts during deployment.
- The long-term risk of noise induced hearing loss with appropriate hearing protection use is **low**.

Confidence in the Risk Assessment: Confidence in the health risk assessment is low. The Services have well-established hearing conservation programs and hearing protection is readily available and generally worn by individuals in occupations with known occupational noise exposures. However, the limited availability of information about specific noise sources and enforcement of the use of personal protective equipment diminishes confidence.
Return to Table 2

9.2 Impulse

9.2.1 Short-term (Acute) and Long-term (Chronic) Health Risks

Approach: No information about potential sources of impulse noise (140 dbA or greater) is available for Base Camp Jebel Ali.

Risk Assessment:

- Short-term health risk: **Not evaluated**; insufficient data exist upon which to base a health risk assessment.
- Long-term health risk: **Not evaluated**; insufficient data exist upon which to base a health risk assessment.

10 Unique Concerns

10.1 Asbestos and Lead-Based Paint

10.1.1 Site Specific Conditions

No data on asbestos containing material or peeling lead-based paint are available for Base Camp Jebel Ali.

10.1.2 Short-term (Acute) and Long-term (Chronic) Health Risk

Approach: No data on asbestos and lead-based paint available.

Risk Assessment:

- Short-term health risk: **Not evaluated**; insufficient data exist upon which to base a health risk assessment.
- Long-term health risk: **Not evaluated**; insufficient data exist upon which to base a health risk assessment.

Return to Table 2

10.2 Potential Environmental Contamination Sources

10.2.1 Site Specific Conditions

In addition to environmental exposures already discussed, there may be specific occupational exposure pathways associated with vehicle, aircraft, patrol craft and site maintenance. Typical chemicals of concern associated with potential occupational exposures are petroleum, oils, and lubricants. Occupational exposures to these stressors are generally well characterized in garrison and there are procedures in place for storing, handling, using and disposing hazardous materials which generally minimize health risk.

10.2.2 Short-term (Acute) and Long-term (Chronic) Health Risks

Approach: Review of existing industrial hygiene data for Camp Base Jebel Ali.

Risk Assessment:

- Short-term health risk: **Not evaluated**; insufficient data exist upon which to base a health risk assessment.
- Long-term health risk: **Not evaluated**; insufficient data exist upon which to base a health risk assessment.

10.3 Pesticides/Pest Control

10.3.1 Site Specific Conditions

Pest control services on Base Camp Jebel Ali are provided through contract. Contract personnel are required to meet DOD certification requirements or have a state pest control operator's license. Pest

10.3.2 Short-term (Acute) and Long-term (Chronic) Health Risks

Approach: Knowledge of Department of Defense (DOD) and Department of the Navy (DON) policies, which require that contractor provided pest control services be reviewed for compliance with DOD and DON policy.

Risk Assessment:

- Short-term health risk is **low**.
- Long-term health risk is **low.**

Confidence in the Risk Assessment: Confidence in the risk assessment is low as the specific scope of pest control services and mechanism of oversight is unknown.

11 References

POEMS developed according to:

1. **DODI 6490.03, *Deployment Health*, September 2011.**
2. **MCM 0017-12, *Procedures for Deployment Health Surveillance,* December 2012.**
3. **DODI 6055.05, Occupational and Environmental Health, November 2008.**
4. **Klaassen, C.D. *Casarett & Doull's Toxicology: the Basic Science of Exposures*, Chapter 2, Principles of Toxicology; Fifth Edition, McGraw Hill, New York.**

Site description and baseline information obtained from:

5. **Atlantic Division, Naval Facilities Engineering Command Environmental Site Assessment of Proposed U.S. Navy Shore Facility Port of Jebel Ali, Dubai, United Arab Emirates, April 2005.**
6. **Atlantic Division, Naval Facilities Engineering Command Final Environmental Condition of Property Assessment Proposed U.S. Navy Shore Facility Port of Jebel Ali, Dubai, United Arab Emirates 2011 Addendum – Phase II Assessment, April 2012.**
7. **Occupational and Environmental Health Site Assessment, Base Camp Jebel Ali, September 2014.**
8. **Occupational and Environmental Health Site Assessment, Base Camp Jebel Ali, September 2015.**
9. **United Arab Emirates Post Report – eDiplomat – Area, Geography, and Climate Updated http://www.ediplomat.com/np/post_reports/pr_ae.htm, August 12, 2003.**

Sampling data were obtained from the:

10. **Defense Occupational and Environmental Health Readiness System at https://doehrs-ih.csd.disa.mil/Doehrs/.**

Additional environmental health reports/survey documents are from the:

11. **Military Exposure Surveillance Library: https://mesl.apgea.army.mil/mesl**
12. **Department of Veterans Affairs-Environmental Letter – Burn Pits Throughout Iraq, Afghanistan, and Djibouti, April 26, 2010.**

Chemical hazards (air, water, soil) evaluated based on military exposure guidelines (MEGs) and risk assessment methodology in:

13. **USAPHC Technical Guide (TG230): Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel, December, 2013 Revision.**
14. **USACHPPM, Particulate Matter Factsheet No. 64-009-0708, 2008.**
15. **National Academy of Sciences, Committee on Toxicology: Acute Exposure Guideline Levels for Selected Airborne Chemicals, Volume 8 (2010).**

Regional/country information on endemic/infectious disease and heat/cold from the:

16. **Centers for Disease Control and Prevention (CDC) Travelers' Health website (http://wwwnc.cdc.gov/travel/destinations/uae.htm), "Destinations" section, UAE.**
17. **World Health Organization Country Profiles/United Arab Emirates (http://www.who.int/countries/are/en/)**
18. **Clinical Toxinology Resources, University of Adelaide, Australia; http://www.toxinology.com/index.cfm.**
19. **Wildlife Middle East News, Volume 2, Issue 3, December 2007.**

NOTE. The DOEHRS-EH database was queried to obtain the available sample data for air, soil, and drinking and nondrinking water sources at Base Camp Jebel Ali, Dubai, UAE. The data are currently assessed using the TG230 December 2013 Revision as described above contains, the general method involves an initial check of the data which eliminates all chemical substances not detected above 1-year Negligible MEG. 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 and water (soil is only evaluated for long-term health risk). This is performed by deriving separate short-term and long-term population exposure level estimates (referred to as population exposure point concentrations) that are compared to MEGs derived for similar exposure durations. If exposure point concentrations are less than or equal to Negligible MEGs, the risk is low. If levels are higher than the respective Negligible MEG, then a chemical-specific toxicity and exposure evaluation is completed by appropriate subject matter experts, which includes comparison to any available marginal, critical, or catastrophic MEGs. For drinking water, 15-L/day MEGs are used for screening while site specific 5–15L/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 USEPA regulatory limits), which is derived by multiplying the 5-L/day MEG by a factor of 2.5. This value is used to conservatively assess nondrinking uses of water.

12 Where Do I Get More Information?

If a provider feels that the Service member's or Veteran's current medical condition may be attributed to specific OEH exposures at this deployment location, he/she can contact the Service-specific organization below. Organizations external to DOD should contact DOD Force Health Protection and Readiness.

Army Public Health Center Phone: (800) 222-9698. **http://phc.amedd.army.mil/**

Navy and Marine Corps Public Health Center (NMCPHC) Phone: (757) 953-0700. **http://www-nmcphc.med.navy.mil/**

U.S. Air Force School of Aerospace Medicine (USAFSAM) Phone: (888) 232-3764. **http://www.wpafb.af.mil/afrl/711hpw/usafsam.asp**

DOD Health Readiness Policy and Oversight Phone: (800) 497-6261. **https://health.mil/Military-Health-Topics/Health-Readiness**