Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS): Shuaiba Port, Camp Arifjan, and Kuwait Naval Base, Kuwait: 2009 to 2014

AUTHORITY: This periodic occupational and environmental monitoring summary (POEMS) has been developed in accordance with Department of Defense (DoD) Instructions 6490.03, 6055.05, and JCSM (MCM) 0028-07, (References 1-3).

PURPOSE: This POEMS documents the Department of Defense (DoD) assessment of deployment occupational and environmental health (OEH) risk for Shuaiba Port and vicinity that includes Camp Arifjan and Kuwait Naval Base (KNB). It presents a qualitative summary of health risks identified at this location and their potential medical implications. The report is based on information collected from 01 January 2009 through 07 September 2014 to include deployment OEHS sampling and monitoring data (e.g., air, water, and soil), field investigation and health assessment reports, as well as country and area-specific information on endemic diseases.

This assessment assumes that the OEH sampling for Shuaiba Port and vicinity during this period was performed at representative exposure points selected to characterize health risks at the *population–level*. Due to the nature of environmental sampling, the data upon which this report is based may not be fully representative of all the fluctuations in environmental quality or capture unique occurrences. While one might expect health risks pertaining to historic or future conditions at this site to be similar to those described in this report, the health risk assessment is limited to 01 January 2009 through 07 September 2014.

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

SITE DESCRIPTIONS: In support of Operation Iraqi Freedom/New Dawn, U.S. Forces utilize a portion of the Shuaiba Port Industrial Area. Army personnel are typically deployed to Shuaiba Port and Camp Arifjan for one year; some Navy personnel are also deployed to this site for 6 months. Army personnel primarily conduct security/guard duties at Shuaiba Port, though some support ship loading/unloading operations. Daily work shifts are predominantly 12 hours with some 8-hour shifts. Navy personnel shifts are 8 hours. When not on duty, personnel are typically at the respective life support areas (LSA's) which provide primary housing, food, and drinking water supplies. Prior to the summer of 2005, the LSA for Shuaiba Port was located within the Industrial Area. Current LSA's are located 20 – 40 kilometers (km) away at less industrialized locations. The primary LSA for Shuaiba Port is Camp Arifjan, which houses over 80 percent (%) of the personnel working at Shuaiba Port. A few personnel including Navy personnel are housed at a secondary LSA located at the KNB, approximately 20 km south of Shuaiba Port.

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 Shuaiba Port 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 Shuaiba Port and vicinity that includes Camp Arifjan and Kuwait Naval Base:

The following may have caused acute health effects in some personnel *during deployment at* Shuaiba Port and vicinity, Kuwait*:*

Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}); inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$); food/waterborne diseases (e.g., bacterial diarrhea, Hepatitis A, Typhoid fever, diarrhea-cholera, diarrhea-protozoal); other endemic diseases (cutaneous leishmaniasis, scrub Typhus (mite-borne), Tuberculosis (TB), Leptospirosis, Q fever); heat stress; continuous noise; fuel/petroleum products/industrial chemical spills. For food/waterborne diseases (e.g., bacterial diarrhea, hepatitis A, Typhoid fever, diarrhea-cholera, diarrhea-protozoal), if ingesting local food and water, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (Hepatitis A, Typhoid fever). 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, 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 and bed net, and appropriate chemoprophylaxis. For respiratory diseases (Tuberculosis (TB)), personnel in close-quarter conditions could have been at risk for person-to-person spread. For water contact diseases (Leptospirosis) activities involving extensive contact with surface water increase risk. Animal contact diseases (Q fever), pose year-round risk. For heat stress, risk can be greater during months of May through October, and for susceptible persons including those older than 45, of low fitness level, or with underlying medical conditions. Risks from heat stress may have been reduced with preventive medicine controls, work-rest cycles, and mitigation. For continuous noise exposure, the short-term risk is to personnel working near major noise sources; risk may have been reduced to personnel working near major noise sources by wearing proper hearing protection. For fuel/petroleum products/industrial chemical spills, personnel conducting ship loading/unloading operations may experience exposures to hydraulic fluid and engine oil due to leakage and maintenance; risk may be moderate for individuals conducting specific operations without wearing proper protective equipment.

Air quality: For inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}), the PM_{10} overall short-term risk was 'None to High' for Shuaiba Port and vicinity. For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$), the $PM_{2.5}$ overall short-term risk was 'Low to High' for Shuaiba Port and vicinity. However, the entire Shuaiba Port 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. Although most effects from exposure to particulate matter 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 Shuaiba Port and vicinity, Kuwait. Personnel who reported with symptoms or required treatment while at this site should have exposure/treatment noted in medical record (e.g., electronic medical record and/or on a Standard Form (SF) 600 (*Chronological Record of Medical Care*).

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Table 1: Continued

Long-term health risks & medical implications:

The following hazards may be associated with potential chronic health effects in some personnel during deployment at Shuaiba Port and vicinity that includes Camp Arifjan and Kuwait Naval Base:

The hazards associated with potential long-term health effects at Shuaiba Port and vicinity, Kuwait, include inhalable fine $PM_{2.5}$, continuous noise, and fuel/petroleum products/industrial chemical spills.

For continuous noise exposure, the long-term risk is to personnel working near major noise sources. Risk may have been reduced to personnel working near major noise sources (e.g., persons working on or near ship loading/unloading operations) by wearing proper hearing protection. 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). For fuel/petroleum products/industrial chemical spills, personnel conducting ship loading/unloading operations may experience exposures to hydraulic fluid and engine oil due to leakage and maintenance; risk may be moderate for individuals conducting specific operations without wearing proper protective equipment.

Air Quality: For inhalable $PM_{2.5}$ from environmental dust, the overall long-term risk was 'Moderate' for Shuaiba Port and vicinity. Inhalable coarse PM_{10} from environmental dust was not evaluated for long-term risk due to no available health guidelines. However, the entire Shuaiba Port and vicinity area is an arid and dust-prone desert environment, also subject to vehicle traffic, and conditions may have varied. For inhalational exposure to high levels of dust and particulate matter, such as during high winds or dust storms, 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 PM exposures are documented and archived, at this time there are no specific recommended, post-deployment medical surveillance evaluations or treatments. Providers should still consider overall individual health status (e.g., any underlying conditions/susceptibilities) and any potential unique individual exposures (such as occupational or specific personal dosimeter data) when assessing individual concerns.

Table 2. Population-Based Health Risk Estimates – Shuaiba Port and vicinity that includes Camp Arifjan and Kuwait Naval Base. [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: (None 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: (None to High) Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).
	Long-term: No health guidelines		Long-term: No health guidelines
Particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$)	Short-term: (Low to High) A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: (Low to High) A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.
	Long-term: 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).
$PM_{2.5}$ airborne metals	Short-term: Low risk (for cadmium)		Short-term: Low risk (for cadmium)
	Long-term: Low risk (for cadmium)		Long-term: Low risk (for cadmium)
Chemical Pollutants (organic and inorganic gases)	Short-term: No risk (for O_3, NO_2,CO, H_2S, NH_3, acrolein) to Low (for SO_2).		Short-term: No risk (for O_3, NO_2, CO, H_2S, NH_3, acrolein) to Low (for SO_2).
	Long-term: No risk (for NO_2, CO, H_2S, NH_3, SO_2) to Low (for acrolein, O_3)		Long-term: No risk (for NO_2, CO, H_2S, NH_3, SO_2) to Low (for acrolein, O_3)

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
ENDEMIC DISEASE			
Food borne/Waterborne (e.g., diarrhea-bacteriological)	Short-term: Variable, High (for bacterial diarrhea), to Moderate (for hepatitis A, typhoid fever, diarrhea-cholera, diarrhea-protozoal,), to Low (for brucellosis, 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: none identified
Arthropod Vector Borne	Short-term: Variable, Moderate (for leishmaniasis-cutaneous, typhus-miteborne), Low (for Sandfly fever, Sindbis, West Nile fever)	Preventive measures include proper wear of treated uniform, application of repellent to exposed skin, and bed net use, minimizing areas of standing water and appropriate chemoprophylaxis.	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	Recreational swimming in surface waters is not likely in this area during this time.	Short-term: Moderate for leptospirosis.
	Long-term: None identified		Long-term: None identified
Respiratory	Short-term: Variable; Moderate (for tuberculosis), and Low (for meningococcal meningitis).	Providing adequate living and work space; medical screening; vaccination	Short-term: Low
	Long-term: None identified		Long-term: None identified
Animal Contact	Short-term: Variable; Moderate (for Q-fever), Low (for rabies, H5N1 avian influenza), and no risk (for Anthrax).	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

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
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., *Androctonus crassicauda*).	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., *Androctonus crassicauda*).
	Long-term: No data available		Long-term: No data available
HEAT/COLD STRESS			
Heat	Short-term: Variable; Risk of heat injury is High (for May – October), Low for all other months.	Work-rest cycles, proper hydration and nutrition, and Wet Bulb Globe Temperature (WBGT) monitoring.	Short-term: Variable; Risk of heat injury in unacclimatized or susceptible personnel is High (for May – October), Low for all other months.
	Long-term: Low, The long-term risk was Low. However, the risk may be greater to certain susceptible persons–those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.		Long-term: Low, The long-term risk is Low. However, the risk may be greater to certain susceptible persons–those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.
Cold	Short-term: Low risk of cold stress/injury.	Risks from cold stress reduced with protective measures such as use of the buddy system, limiting exposure during cold weather, proper hydration and nutrition, and proper wear of issued protective clothing.	Short-term: Low risk of cold stress/injury.
	Long-term: Low; Long-term health implications from cold injuries are rare but can occur, especially from more serious injuries such as frostbite.		Long-term: Low Long-term health implications from cold injuries are rare but can occur, especially from more serious injuries such as frostbite.
NOISE			
Continuous	Short-term: Moderate	Hearing protection used by personnel in higher risk areas (persons working on or near ship loading/unloading operations)	Short-term: Low
	Long-term: Moderate		Long-term: Low
Unique Incidents/ Concerns			
Waste Sites/Waste Disposal	Short-term: Low		Short-term: Low
	Long-term: Low		Long-term: Low

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
Fuel/petroleum products/ industrial chemical spills	Short-term: Moderate	Health risk is Moderate for individuals conducting specific operations without proper personal protection. Risk was reduced to Low with proper protection to mitigate exposure/contact.	Short-term: Low
	Long-term: Moderate		Long-term: Low
Pesticides/Pest Control	Short-term: Low	See Section 10.5	Short-term: Low
	Long-term: Low		Long-term: Low

[1]This Summary Table provides a qualitative estimate of population-based short- and long-term health risks associated with the occupational environment conditions at Shuaiba Port and vicinity that includes Camp Arifjan and Kuwait Naval Base. 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 01 January 2009 through 07 September 2014. Sampling locations are assumed to be representative of exposure points for the camp population but may not reflect all the fluctuations in environmental quality or capture unique exposure incidents.

[3]This Summary Table is organized by major categories of identified sources of health risk. It only lists those sub-categories specifically identified and addressed at Shuaiba Port 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 APHC/ Army Institute of Public Health AIPH. Where applicable, "None Identified" is used when though a potential exposure is identified, and no health risks of either a specific acute or chronic health effects are determined. More detailed descriptions of OEH exposures that are evaluated but determined to pose no health risk are discussed in the following sections of this report.

[4]Health risks in this Summary Table are based on quantitative surveillance thresholds (e.g., endemic disease rates; host/vector/pathogen surveillance) or screening levels, e.g., Military Exposure Guidelines (MEGs) for chemicals. Some previous assessment reports may provide slightly inconsistent health risk estimates because quantitative criteria such as MEGs may have changed since the samples were originally evaluated and/or because this assessment makes use of all historic site data while previous reports may have only been based on a select few samples.

1 Discussion of Health Risks at Shuaiba Port, Camp Arifjan, and KNB by Source

The following sections provide additional information about the deployment OEH conditions summarized 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* (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

Shuaiba Port: Shuaiba Port is situated in a dusty semi-arid desert environment on the Arabian Gulf coast. 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.

Personnel deployed to the Shuaiba Port are potentially exposed to various airborne constituents that have been identified through monitoring and sampling efforts over the years. One constituent of concern is ambient particulate matter (PM) which comes primarily from windblown dust and sand. PM levels at this location fluctuate over time (for instance seasonal variation in the data indicates higher levels in warmer months (summer)). In addition to PM, there are a number of industrial activities (e.g., manufacturing, construction, chemical and fuel storage/ distribution, and asphalt /concrete production) located on and around the Shuaiba Port that may contribute air contaminants such as metals and organic and inorganic gases and vapors. Primary sources are routine industrial emissions (facilities at the site have less environmental controls than would be required in U.S.), or other man-made sources (e.g., vehicles). Blowing sulfur powder has been reported over the years at certain piers when elemental sulfur powder is loaded onto cargo ships for export.

Historical emissions/accidental releases from industrial facilities or chemical storage areas (e.g., reports of blowing sulfur powder in some of the port berths) at this site have resulted in notable health effects and medical treatment of some personnel in the past. For example, in April 2004 specific reported release events involving sulfur dioxide (SO_2) and ammonia (NH_3) resulted in short-term effects (odors, irritation to eyes, nose, and throat). These concerns resulted in some limited sampling from October 2004- May 2005 using multiple Drager MiniWarn portable direct-reading instruments. The data at that time identified varying levels of SO_2, NH_3, chlorine (Cl_2), and hydrogen sulfide (H_2S) and was presented in the Shuaiba Port 2002-2008 POEMS (Reference 5). Chlorine was not sampled for during the current sampling period (01January 2009 – 07 September 2014) since it is not part of the routine sampling effort addressed by laboratory and the onsite Mobile Ambient Air Monitoring Station (MAAMS); therefore, updated information is not available for Cl_2. Sampling data collected

from 01January 2009 – 30 June 2014 via the MAAMS for NH_3, H_2S, carbon monoxide (CO), nitrogen dioxide (NO_2), SO_2, and ozone (O_3) were available for evaluation in this risk assessment.

LSAs: While located 20 – 40 kilometers away, the LSAs (Camp Arifjan, KNB) have similar windblown sand and dust conditions as Shuaiba Port and therefore similar PM exposures occur at these locations. While the sampling is less robust at the LSAs, data as described below appears to support the assumption that these less industrial locations have less of the other airborne constituents identified at the Shuaiba Port.

2.2 Particulate Matter

Particulate matter is a complex mixture of extremely small particles suspended in the air. The PM includes solid particles and liquid droplets emitted directly into the air by sources such as: power plants, motor vehicles, aircraft, generators, construction activities, fires, and natural windblown dust. The PM can include sand, soil, metals, volatile organic compounds (VOC), allergens, and other compounds such as nitrates or sulfates that are formed by condensation or transformation of combustion exhaust. The PM composition and particle size vary considerably depending on the source. Generally, PM of health concern is divided into two fractions: PM_{10}, which includes coarse particles with a diameter of 10 micrometers or less, and fine particles less than 2.5 micron ($PM_{2.5}$), which can reach the deepest regions of the lungs when inhaled. Exposure to excessive PM is linked to a variety of potential health effects (Reference 6).

2.3 Particulate Matter, less than 10 microns (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:

Shuaiba Port: A total of 419 valid PM_{10} air samples were collected from 01 January 2009 – 24 May 2011. Most samples were collected via the MAAMS and some were collected using a Deployment Particulate Matter Sampler (DPS) and Mini-Vol sampler. The range of 24-hour PM_{10} concentrations was 30 $\mu g/m^3$ – 862 $\mu g/m^3$ with an average concentration of 199 $\mu g/m^3$.

Camp Arifjan: No PM_{10} air samples were collected from this location.

KNB: No PM_{10} air samples were collected from this location.

2.3.3 Short-term health risks:

Variable (None to High). The short-term PM_{10} health risk assessment is based on a comparison of air concentrations to 24-hour negligible MEGs. The variable risk is due to significant fluctuation in

daily concentrations. The PM_{10} average concentration (199 ug/m^3) was below the short-term PM_{10} negligible MEG (250 ug/m^3) and was not considered a health hazard. However, the peak PM_{10} concentration (862 ug/m^3) was greater than the short-term PM_{10} critical MEG of 600 ug/m^3. The short-term risk assessment for peak PM_{10} concentrations was High. The PM_{10} was not expected to pose a short-term health risk to personnel on typical days, but peak exposures can occur, increasing the health risk level to High. Daily risk levels show no hazard for 74%, low risk for 20%, moderate risk for 5%, and high risk for 1% of the time. Confidence in the short-term PM_{10} risk assessment was medium (Reference 4, Table 3-6).

The hazard severity for average PM_{10} concentrations in samples was negligible. During average exposures at the negligible hazard severity level, few exposed personnel (if any) are expected to have experience notable 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 critical. During peak exposures at the critical hazard severity level, most, if not all personnel may experience very notable eye, nose, and throat irritation and respiratory effects. Visual acuity is impaired, as is overall aerobic capacity. Some lost-duty days are expected. Those with a history of asthma or cardiopulmonary disease will experience more severe symptoms. Conditions may also result in adverse, non-health related materiel/logistical impacts (Reference 4, Table 3-11).

2.3.4 Long-term health risks:

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 microns ($PM_{2.5}$)

2.4.1 Exposure Guidelines:

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

Long-term $PM_{2.5}$ MEG (µg/m^3):
- Negligible MEG = 15
- Marginal MEG = 65

2.4.2 Sample data/Notes:

Shuaiba Port: A total of 1273 valid $PM_{2.5}$ air samples were collected from 13 January 2009 – 30 June 2014. The range of 24-hour $PM_{2.5}$ concentrations was 2 µg/m^3 – 577 µg/m^3 with an average concentration of 75 µg/m^3.

Camp Arifjan: A total of 241 valid $PM_{2.5}$ air samples were collected from 12 January 2009 – 26 August 2014. The range of 24-hour $PM_{2.5}$ concentrations was 9 µg/m^3 – 519 µg/m^3 with an average concentration of 87 µg/m^3.

KNB: A total of 127 valid $PM_{2.5}$ air samples were collected from 01 April 2009 – 07 September 2014. The range of 24-hour $PM_{2.5}$ concentrations was 4 µg/m^3 – 513 µg/m^3 with an average concentration of 84 µg/m^3.

2.4.3 Short-term health risks:

Variable (Low to High). The short-term health risk is based on a comparison of air concentrations to 24-hour MEGs. The variable risk is due to significant fluctuation in daily concentrations. Confidence in the short-term $PM_{2.5}$ health risk assessment was medium to high (Reference 4, Table 3-6).

Shuaiba Port: The short-term $PM_{2.5}$ health risk is Low based on an average concentration of 75 ug/m^3 and High based on a peak concentration of 577 ug/m^3 and the likelihood of exposure at these hazard severity levels. Daily risk levels for $PM_{2.5}$ show no hazard for 60%, low health risk for 37%, moderate health risk for 2%, and high health risk for 1% of the time.

Camp Arifjan: The short-term $PM_{2.5}$ health risk is Low based on an average concentration of 87 ug/m^3 and High based on a peak concentration of 519 ug/m^3. Daily risk levels for $PM_{2.5}$ show no hazard for 55%, low health risk for 41%, moderate health risk for 3%, and high health risk for 1% of the time.

KNB: The short-term $PM_{2.5}$ health risk is Low based on an average concentration of 84 ug/m^3 and High based on a peak concentration of 513 ug/m^3. Daily risk levels for $PM_{2.5}$ show no hazard for 55%, low health risk for 40%, moderate health risk for 4%, and high health risk for 1% of the time.

The hazard severity was negligible for average $PM_{2.5}$ sample concentrations at all locations. During average exposures at the negligible hazard severity level, 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).

The hazard severity was critical for peak $PM_{2.5}$ sample concentrations at all locations. During peak exposures at the critical hazard severity level, most, if not all personnel may experience very notable eye, nose, and throat irritation and respiratory effects. Visual acuity is impaired, as is overall aerobic capacity. Some lost-duty days are expected. Those with a history of asthma or cardiopulmonary disease will experience more severe symptoms. Conditions may also result in adverse, non-health related materiel/logistical impacts (Reference 4, Table 3-11).

2.4.4 Long-term health risks:

Moderate. The long-term health risk is Moderate and is based on a comparison of air concentrations to a 1-year Negligible MEG. Confidence in the long-term $PM_{2.5}$ health risk assessment was medium to high (Reference 4, Table 3-6).

Shuaiba Port: The long-term $PM_{2.5}$ health risk is Moderate based on an average concentration of 75 ug/m^3 and the likelihood of exposure at these hazard severity levels.

Camp Arifjan: The long-term $PM_{2.5}$ health risk is Moderate based on an average concentration of 87 ug/m^3 and the likelihood of exposure at these hazard severity levels.

KNB: The long-term $PM_{2.5}$ health risk is Moderate based on an average concentration of 84 ug/m^3 and the likelihood of exposure at these hazard severity levels.

The hazard severity was marginal for average $PM_{2.5}$ sample concentrations at all locations. During average exposures at the marginal hazard severity level, it is plausible that the development of chronic health conditions such as reduced lung function or exacerbated chronic bronchitis, chronic obstructive pulmonary disease (COPD), asthma, atherosclerosis, or other cardiopulmonary diseases could occur in generally healthy troops. Those with a history of asthma or cardiopulmonary disease are considered to be at particular risk (Reference 4, Table 3-11).

2.5 Airborne Metals

2.5.1 Exposure Guidelines

Short-term Cadmium MEGs (µg/m^3):

- 8-hour Negligible = 41.0
- 14-day Negligible = 0.0205

Long-term Cadmium MEG (µg/m^3):

- 1-year Negligible = 0.00685

2.5.2 Sample data/Notes:

The degree of risk is estimated based on comparison of metals results from ambient air particulate matter samples to specified MEGs. Samples were collected at Shuaiba Port from 21 January 2009 to 24 May 2011 for PM_{10} metals in air and at Camp Arifjan, KNB, and Shuaiba Port from 12 January 2009 to 25 September 2014 for $PM_{2.5}$ metals in air.

Shuaiba Port: A total of 52 PM_{10} airborne samples for metal analyses, and a total of 218 $PM_{2.5}$ airborne samples were collected for metal analyses.

Camp Arifjan: No PM_{10} airborne metal samples were collected from this location. A total of 215 $PM_{2.5}$ airborne samples were collected for metal analyses.

KNB: No PM_{10} airborne metal samples were collected from this location. A total of 126 $PM_{2.5}$ airborne samples were collected for metal analyses.

2.5.3 Short-term health risks:

Shuaiba Port: No health risks were identified for PM_{10} airborne metals at this location. For $PM_{2.5}$, the airborne metal, cadmium, had an average (0.018 ug/m^3) and peak (0.134 ug/m^3) sample concentration that exceeded the short-term 14-day negligible MEG (0.0205 ug/m^3). The short-term health risk for $PM_{2.5}$ airborne cadmium sample concentrations is Low. Confidence in the health risk assessment is medium (Reference 4, Table 3-6).

Camp Arifjan: For $PM_{2.5}$, the airborne metal, cadmium, had an average (0.019 ug/m^3) and peak (0.386 ug/m^3) sample concentration that exceeded the short-term 14-day negligible MEG (0.0205

ug/m^3). The short-term health risk for $PM_{2.5}$ airborne cadmium sample concentrations is Low. Confidence in the health risk assessment is medium (Reference 4, Table 3-6).

KNB: For $PM_{2.5}$, the airborne metal, cadmium, had an average (0.016 ug/m^3) and peak (0.023 ug/m^3) sample concentration that exceeded the short-term 14-day negligible MEG (0.0205 ug/m^3). The short-term health risk assessment for $PM_{2.5}$ airborne cadmium sample concentrations is Low. Confidence in the health risk assessment is medium (Reference 4, Table 3-6).

Short-term health effects from the inhalation of high levels of cadmium fumes or dust may cause intense irritation to respiratory tissue (Reference 13).

2.5.4 Long-term health risks:

Low. The long-term health risk is Low and is based on a comparison of air concentrations to 1-year negligible MEGs.

Shuaiba Port: No health risks were identified for PM_{10} airborne metals at this location. For $PM_{2.5}$, the airborne metal, cadmium, had an average (0.018 ug/m^3) sample concentration that exceeded the long-term 1-year negligible MEG (0.00685 ug/m^3). The long-term health risk for $PM_{2.5}$ airborne cadmium sample concentrations is Low. Confidence in the health risk assessment is medium (Reference 4, Table 3-6).

Camp Arifjan: For $PM_{2.5}$, the airborne metal, cadmium, had an average (0.019 ug/m^3) sample concentration that exceeded the long-term 1-year negligible MEG (0.00685 ug/m^3). The long-term health risk assessment for $PM_{2.5}$ airborne cadmium sample concentrations is Low. Confidence in the health risk assessment is medium (Reference 4, Table 3-6).

KNB: For $PM_{2.5}$, the airborne metal, cadmium, had an average (0.016 ug/m^3) sample concentration that exceeded the long-term 1-year negligible MEG (0.00685 ug/m^3). The long-term health risk assessment for $PM_{2.5}$ airborne cadmium sample concentrations is Low. Confidence in the health risk assessment is medium (Reference 4, Table 3-6).

Long-term health effects from breathing air with low levels of cadmium over long periods of time (for years) results in a build-up of cadmium in the kidney, and if sufficiently high, may result in kidney disease (Reference 13).

2.6 Chemical Pollutants (gases and vapors)

2.6.1 Exposure Guidelines

Short-term Acrolein MEGs (µg/m^3):

- 8-hour Negligible = 70.0
- 14-day Negligible = 46.0

Long-term Acrolein MEG (µg/m^3):

- 1-year Negligible = 0.14

Short-term O_3 MEGs (µg/m^3):

- 8-hour Negligible = 393

Long-term O_3 MEG (µg/m^3):

- 1-year Negligible = 39

- 14-day Negligible = 39

Short-term SO_2 MEGs ($\mu g/m^3$):

- 8-hour Negligible = 520
- 14-day Negligible = 524

Long-term SO_2 MEG ($\mu g/m^3$):

- 1-year Negligible = 524

2.6.2 Sample data/Notes:

Shuaiba Port: A total of 210 air samples were collected from 09 January 2009 – 21 June 2014 and were analyzed for VOCs via the non-routine sampling equipment (e.g., T015 samplers). In addition, samples were collected from 01 January 2009 – 30 June 2014 from the MAAMS for O_3, SO_2, NO_2, CO, H_2S, and NH_3. Table 3 provides information (e.g., number of samples, maximum concentrations, and average concentrations) for the VOCs collected.

Table 3. VOCs collected at Shuaiba Port.

VOC	Number of Samples	Maximum Concentration ($\mu g/m^3$)	Average Concentration ($\mu g/m^3$)
Acrolein	210	3.3	0.8
Ozone	1709	131	44
Sulfur Dioxide	1560	626	42
Nitrogen Dioxide	1844	151	61
Carbon Monoxide	1681	4061	682
Hydrogen Sulfide	1076	92	7
Ammonia	609	115	3

Camp Arifjan: No chemical air samples were collected from this location.

KNB: No chemical air samples were collected from this location.

2.6.3 Short-term health risks:

None to Low. The short-term health risk is Variable based on average and peak chemical concentrations, and the likelihood of exposure at these hazard severity levels. Confidence in the short-term SO_2 health risk assessment was high (Reference 4, Table 3-6).

Shuaiba Port: The short-term SO_2 health risk assessment is Low based on peak SO_2 sample concentrations indicated in Table 4. Short-term health effects of SO_2 exposure can result in difficulty breathing, changes in the ability to breathe as deeply or take in as much air per breath, and burning of nose and throat (Reference 14). Exposed personnel are expected to be able to perform all critical tasks during mission operations. Minimal to no degradation of abilities to conduct complex tasks are expected (Reference 4, Table 3-2).

The peak PEPC (population exposure point concentration) for acrolein, NH_3, H_2S, CO, NO_2, and O_3 did not exceed the 14-day Negligible MEG or 8 hour MEG, when the 14-day Negligible MEG was the same as the 1-year Negligible MEG, as shown in Table 4. Therefore, there is not an acute hazard.

Table 4. Maximum chemical concentrations compared to the short-term MEGs.

VOC	Maximum Concentration ($\mu g/m^3$)	14-Day Negligible MEG ($\mu g/m^3$)	8 hour MEG ($\mu g/m^3$)	Exceeded MEG
Acrolein	3.3	5.9	N/A	No
Ozone	131	---	393	No
Sulfur Dioxide	626	524	N/A	Yes
Nitrogen Dioxide	151	941	N/A	No
Carbon Monoxide	4061	10300	N/A	No
Hydrogen Sulfide	92	460	N/A	No
Ammonia	115	6970	N/A	No

N/A = Not Applicable
--- = Unavailable

2.6.4 Long-term health risks:

None to Low. The long-term health risk assessment is Variable based on average chemical concentrations, and the likelihood of exposure at these hazard severity levels. Confidence in the long-term risk assessment for chemical pollutants is high (Reference 4, Table 3-6).

Shuaiba Port: Average concentrations for SO_2, NO_2, CO, H_2S, and NH_3 indicated in Table 5 were below the 1-year Negligible MEGs; therefore, there is no long-term health risk. However, the average concentration for acrolein and O_3 exceeded the 1-year Negligible MEG. The hazard severity for acrolein and O_3 is negligible. The long-term health risk from acrolein and O_3 is Low. Health effects from long-term exposures to acrolein and O_3 are currently not known (Reference 15 and 16).

Table 5. Average chemical concentrations compared to the 1-year Negligible MEG.

VOC	Average Concentration ($\mu g/m^3$)	1-year Negligible MEG ($\mu g/m^3$)	Exceeded MEG
Acrolein	0.8	0.14	Yes
Ozone	44	39	Yes
Sulfur Dioxide	42	524	No
Nitrogen Dioxide	61	941	No
Carbon Monoxide	682	7010	No
Hydrogen Sulfide	7	14	No
Ammonia	3	69	No

3 Soil

3.1 Site-Specific Sources Identified:

3.2 Sample data/Notes:

The primary soil contamination exposure pathways are dermal contact and dust inhalation. Typical parameters analyzed for included semi volatile organic compounds (SVOCs), heavy metals, polychlorinated biphenyls (PCBs), pesticides, herbicides. If the contaminant was known or suspected,

other parameters may have been analyzed for (i.e., Total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAH) near fuel spills). For the risk assessment, personnel are assumed to remain at this location for 6 months to 1 year.

Shuaiba Port: No surface soil samples were collected from this location.

Arifjan: A total of three valid surface soil samples were collected on 15 November 2012 to assess OEH health risk to deployed personnel.

KNB: No surface soil samples were collected from this location.

3.3 Short-term health risks:

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 risks:

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

4 Water

In order to assess the health risk to U.S. personnel from exposure to water in theater, the Army Public Health Command (APHC) 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. At this time, the exposure pathways are primary ingestion from a mix of bottled and reverse osmosis water purification unit (ROWPU) treated water and non-drinking water.

4.1 Drinking Water: Bottled or Packaged Water

4.1.1 Site-Specific Sources Identified

To assess the potential for adverse health effects to troops, the following assumptions were made about dose and duration: A conservative (protective) assumption was that personnel routinely ingested 15 liters per day (L/day) of bottled water for up to 365 days (1-year).

4.1.2 Sample data/Notes:

Shuaiba Port: A total of two water samples were collected from a water distribution system from 31 March 2010 – 7 December 2010. No chemicals were detected above the short or long-term MEGs.

Camp Arifjan: A total of 29 water samples (7 bottled and 22 municipal) were collected from 12 August 2009 –19 June 2014. No chemicals were detected above the short or long-term MEGs.

KNB: A total of six water samples (1 bottled, 4 municipal, and 1 disinfected fresh water sample) were collected from 7 December 2010 – 04 December 2012. No chemicals were detected above the short or long-term MEGs.

4.1.3 Short-term and long-term health risks:

None identified based on available sample data. No health risks from drinking water exposures were identified based on the available data. All collected samples were below the short and long-term negligible MEGs.

4.2 Non-Drinking Water: Used for Other Purposes (Personal Hygiene, Cooking, Showering, etc.)

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.

Shuaiba Port: A total of four municipal water samples were collected from 4 December 2009 – 28 June 2012. No chemicals were detected above the short or long-term MEGs.

Camp Arifjan: A total of 12 water samples (7 bottled and 22 municipal) were collected from 11 December 2009 –19 June 2014. No chemicals were detected above the short or long-term MEGs.

KNB: A total of three water samples (1 ROWPU and 2 municipal water samples) were collected from 7 September 2010 – 27 December 2011. No chemicals were detected above the short or long-term MEGs.

4.2.3 Short-term and long-term health risks:

None identified based on available sample data. No health risks from non-drinking exposures were identified based on the available data. All collected samples were below the short and long-term negligible MEGs.

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, Reference 1) or the Military Exposure Surveillance Library (MESL, Reference 7) from 1 January 2009 – 07 September 2014 timeframe.

5.2 Depleted Uranium (DU):

No specific hazard sources were documented in the DOEHRS or MESL from 1 January 2009 - 07 September 2014 timeframe.

5.3 Ionizing Radiation:

No specific hazard sources were documented in the DOEHRS or MESL from 1 January 2009 - 07 September 2014 timeframe.

5.4 Non-Ionizing Radiation:

No specific hazard sources were documented in the DOEHRS or MESL from 1 January 2009 - 07 September 2014 timeframe.

6 Endemic Diseases

This document lists the endemic diseases reported in the region, the specific health risks and severity and general health information about the diseases. USCENTCOM MOD 12 (Reference 8) 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 can be expected to temporarily incapacitate a very high percentage of personnel (potentially over 50 percent per month) within days if local food, water, or ice is consumed. Field conditions (including lack of hand washing and primitive sanitation) may facilitate person-to-person spread and epidemics. Typically, these result in mild disease treated in outpatient setting; recovery and return to duty in less than 72 hours with appropriate therapy. A small proportion of infections may require greater than 72 hours limited duty, or hospitalization.

6.1.2 Hepatitis A, typhoid fever, and diarrhea-protozoal

High, mitigated to Low: Hepatitis A, typhoid fever, and diarrhea-protozoa can cause prolonged illness. Hepatitis A and typhoid fever can cause prolonged illness in a small percentage of personnel, (less than 1 percent per month) and have a high risk estimate if no preventative medicine measures are taken. However, because all deployed U.S. Forces, including civilians and contractors, are supposed to be vaccinated for Hepatitis A and Typhoid fever, no risk is identified for U.S. Forces from Hepatitis A and Typhoid fever. Diarrhea-cholera and diarrhea-protozoal have a moderate risk estimate if no preventive medicine measures are taken to mitigate, although cases for all are rare. Mitigation is in place, U.S. Personnel do not drink untreated water. Water consumed by U.S./DOD personnel is treated on military camps. A typical case of Hepatitis A involves 1 to 3 weeks of debilitating symptoms, sometimes initially requiring inpatient care; recovery and return to duty may require a month or more. With appropriate treatment, typhoid fever is a debilitating febrile illness that typically requires 1 to 7 days of supportive care, followed by return to duty. Symptomatic cases of diarrhea – protozoal may vary in severity; typically mild disease demonstrating recovery and return to duty in less than 72 hours with appropriate therapy; severe cases may require 1 to 7 days of supportive care, followed by return to duty.

6.1.3 Short-term health risks:

Variable (Low to High): The overall short-term unmitigated risk associated with Food borne and Waterborne diseases in the Shuaiba Port area is considered High for bacterial diarrhea, Moderate for diarrhea-cholera, diarrhea-protozoal, Hepatitis A, and typhoid fever, and Low for brucellosis and Hepatitis E if local food or water is consumed. Preventive Medicine measures such as vaccinations reduce the risk estimate to none (for Hepatitis A and Typhoid fever). Additionally, U.S. Forces are provided food and water from approved sources. Confidence in risk estimate is medium.

6.1.4 Long-term health risks:

None identified based on available data.

6.2 Arthropod Vector-Borne Diseases

Ecological conditions in rural areas support arthropod vectors, including ticks and sand flies, with variable rates of disease transmission. A variety of vector-borne diseases occur at low levels. Individually, most of these diseases are likely to cause only rare cases, but the overall risk may be significant in some areas.

6.2.1 Leishmaniasis

Moderate, mitigated to Low: Leishmaniasis is transmitted by sandflies. The disease risk is Moderate in March through November when sandflies are most prevalent, but reduced to low with mitigation measures. 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 can be disfiguring. Visceral leishmaniasis causes a severe febrile illness, which typically requires hospitalization with convalescence over 7 days. Mitigation measures in place include individual protective measures (i.e., permethrin treated uniforms). Definitive treatment previously required non-urgent evacuation to the continental United States; currently, not all cases require evacuation.

6.2.2 Sindbis

Low: The Sindbis Virus (SINV) is transmitted by mosquitoes (*Culex* spp.) and causes sindbis fever in humans. The symptoms include arthralgia, rash, and malaise. The Sindbis virus is an "arbovirus" (arthropod-borne) and is maintained in nature by transmission between vertebrate (bird) hosts and invertebrate (mosquito) vectors. Humans are infected with Sindbis virus when bitten by an infected mosquito. Sindbis and Sindbis-like viruses are among the most geographically widespread of all arboviral diseases. Sindbis presents a low risk to personnel but is potentially present year-round. However, it would tend to peak in the April to October timeframe.

6.2.3 Sandfly fever

Low: Sandfly fever has a Low risk although it is estimated that potential disease rates are from 1 percent to 10 percent of personnel could be affected per month under worst case conditions. It is transmitted by sandflies and occurs more commonly in children though adults are still at risk. Incidents can result in debilitating febrile illness typically requiring 1-7 days of supportive care followed by return to duty.

6.2.4 Typhus-miteborne

Moderate: Typhus-miteborne has a moderate risk estimate although it is estimated that potential disease rates are from 1 percent to 10 percent of personnel could be affected per month under worst case conditions. The disease is transmitted by the larval stage of trombiculid mites (chiggers), which are typically found in areas of grassy or scrubby vegetation. The disease can cause debilitating febrile illness typically requiring 1 to 7 days of inpatient care, followed by return to duty.

6.2.5 West Nile fever

Low: West Nile fever is present and is maintained by the bird population and mosquitoes that help to transfer the diseases from birds to humans. The majority of infections in young, healthy adults are asymptomatic although it can result in fever, headache, tiredness, and body aches, occasionally with a skin rash (on the trunk of the body) and swollen lymph glands. This disease is associated with a low risk estimate.

6.2.6 Short-term health risks:

Low: The unmitigated risk is moderate for Leishmaniasis - cutaneous (acute), typhus-miteborne; and Low for Sindbis, Sandfly fever, and West Nile fever. Health risk is reduced to low by proper wear of the uniform, application of repellent to exposed skin, and appropriate chemoprophylaxis. Confidence in the risk estimate is medium.

6.2.7 Long-term health risks:

Low: Low (for the visceral [chronic] leishmaniasis). Confidence in the risk estimate is medium.

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. 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: Leptospirosis is present in Kuwait but at unknown levels. Human infection occurs through exposure to water or soil contaminated by infected animals and has been 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 pass directly into surface waters. Leptospira can enter the body through cut or abraded skin, mucous membranes, and conjunctivae. Ingestion of contaminated water can also lead to infection. The acute generalized illness associated with infection can 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. However, with the exception of Navy divers, there is no swimming, wading, or any other contact with water for Shuaiba Port personnel. Incidence could result in debilitating febrile illness typically requiring 1 to 7 days of inpatient care, followed by return to duty; some cases may require prolonged convalescence. This disease is associated with a Moderate health risk estimate.

6.3.2 Short-term health risks:

Low: Unmitigated health risk of leptospirosis is Moderate during warmer months. Mitigation

measures reduce the risk to Low. Confidence in the health risk estimate is medium.

6.3.3 Long-term health risks:

None identified based on available data.

6.4 Respiratory Diseases

Although not specifically assessed in this document, deployed U.S. forces may be exposed to a wide variety of common respiratory infections in the local population. These include influenza, pertussis, viral upper respiratory infections, viral and bacterial pneumonia, and others. The U.S. military populations living in close-quarter conditions are at risk for substantial person-to-person spread of respiratory pathogens. Influenza is of particular concern because of its ability to debilitate large numbers of 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: Tuberculosis (TB) poses a moderate year round risk to U.S. personnel. Tuberculosis is usually transmitted through close and prolonged exposure to an active case of pulmonary or laryngeal tuberculosis, but can also occur with incidental contact. The Army SG has defined increased risk in deployed Soldiers as indoor exposure to locals or third country nationals of greater than one hour per week in a highly-endemic active TB region. Additional mitigation included active case isolation in negative pressure rooms, where available.

6.4.2 Meningococcal meningitis

Low: Meningococcal meningitis poses a low year round 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. Asymptomatic colonization and carriage of meningococcal bacteria are common worldwide, including within U.S. military populations; rare symptomatic cases may occur periodically in military populations, regardless of geographic location. Neisseria meningitides group A predominates regionally. 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 (for tuberculosis) to Low (for meningococcal meningitis). Confidence in the risk estimate is medium. Overall risk was reduced to Low with mitigation measures.

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

Low: Rabies poses a year round low risk. Occurrence is comparable to U.S. levels. 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. Personnel bitten by potentially infected reservoir species may develop rabies in the absence of appropriate prophylaxis. The circumstances of the bite should be considered in evaluating individual health risk; in addition to dogs and cats, bats or wild carnivores should be regarded as rabid unless proven otherwise. General Order 1B mitigates rabies risk by prohibiting contact with or adoption or feeding of feral animals. Very severe illness with near 100% fatality rate can occur in the absence of post-exposure prophylaxis. Typically, the time period from exposure to the onset of symptoms is 2-12 weeks, but can rarely take several years.

6.5.2 Anthrax

No Risk: Anthrax does not pose a 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 percent) can occur in personnel with heavy exposure to barnyards or other areas where animals are kept. Unpasteurized milk may also transmit infection. Note: while cattle, sheep, and goats are primary carriers of this bacteria, camels, a common animal in the Shuaiba Port area, are also reported/known to be carriers. The primary route of exposure is respiratory, with an infectious dose as low as a single organism. Incidence could result in dehabilitating 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 risk to U.S. personnel is low. Extremely rare cases may occur in U.S. personnel who have close contact with birds or poultry infected with H5N1. Human infections have occurred on a very rare basis and have been associated with activities involving close, direct contact with infected poultry, such as plucking, slaughter, or other handling. There is no health risk from consumption of properly cooked poultry products. Human-to-human transmission appears to be exceedingly rare, even among relatively close contacts. 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% 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 Q-fever), Low (for rabies and H5N1 avian influenza), and No risk for anthrax. Mitigation measures reduced the overall risk to Low. Confidence in the risk estimate is medium.

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 9) and the Clinical Toxinology Resources web site from the University of Adelaide, Australia (Reference 10). The species listed below have home ranges that overlap the location of Shuaiba Port and vicinity, and may present a health risk if they are encountered by personnel.

7.1 Spiders

No spiders were identified

7.2 Scorpions

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

- *Apistobuthus pterygocercus, Buthacus leptochelys, Compsobuthus arabicus, 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.

- *Scorpio maurus*: Mild envenoming only, not likely to prove lethal.

7.3 Snakes

- *Astrotia stokesii, Hydrophis gracilis, Hydrophis lapemoides, Hydrophis spiralis, Lapemis curtus, Thalassophina viperina* : Clinical effects uncertain, but related to medically important species, therefore major envenoming cannot be excluded.

- *Cerastes gasperettii:* Unknown, but potentially lethal envenoming, though unlikely, cannot be excluded.

- *Echis sochureki, Enhydrina schistose, Hydrophis cyanocinctus, Hydrophis ornatus, Pelamis platurus, Vipera albicornuta*: *S*evere envenoming possible, potentially lethal.

- *Malpolon monspessulanus*: Moderate envenoming possible but unlikely to prove lethal

- *Eryx jayakari*: Bite most unlikely to cause fatality.

- *Lytorhynchus diadema, Malpolon moilensis, Platyceps rhodorachis, Platyceps ventromaculatus, Pseudocerastes persicus* : Not likely to cause significant effects; non-lethal.

7.4 Short-term health risks:

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.

7.5 Long-term health risks:

None identified.

8 Heat/Cold Stress

8.1 Heat

Extended summer months (May through October) exhibit a maximum high temperature of 115 degrees Fahrenheit (ºF) and a minimum low of 73ºF, with a mean daily high temperature of 108ºF and a mean daily low temperature of 81ºF. Diurnal temperatures can vary as much as 25ºF. The health risk of heat stress/injury based on temperatures alone is 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 11). 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 risks:

High, mitigated to Low: The risk of heat injury was reduced to low through preventive measures such as work/rest cycles, proper hydration and nutrition, and monitoring Wet Bulb Globe Temperature (WBGT). Risk of heat injury in unacclimatized or susceptible populations (older, previous history of heat injury, poor physical condition, underlying medical/health conditions), and those under operational constraints (equipment, PPE, vehicles) is High from May – October. Confidence in the health risk estimate is low.

8.1.2 Long-term health risks:

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

8.2 Cold

Extended winter months(November through April) exhibit a maximum high temperature of 88ºF and a minimum low temperature of 46ºF, with a mean daily high temperature of 73ºF and a mean daily low temperature of 54ºF. 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 month – month. 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.

8.2.1 Short-term and long-term health risks:

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

9 Noise

9.1 Continuous:

Ship loading and unloading operations at the Shuaiba Port create outdoors noise levels that occasionally fluctuate above the threshold level requiring single-level hearing protection (85 dBA). This occurrence was documented in the OEHSA and certain personnel (e.g., forklift operators etc.) did not have proper hearing protection (Reference 12). In addition, it is noted that health effects of noise exposure (as low as 80 dBA) occurring the same time as exposures to certain chemicals (carbon monoxide, aircraft fuels and industrial chemicals) that are reasonably anticipated in Shuaiba Port can cause permanent hearing loss. For the majority of personnel on this site, noise levels above the hearing protection threshold are for short durations and average daily exposures are below levels requiring participation in a hearing conservation program. For those individuals working on/or near ship loading/unloading operations there are noted higher levels that can result in increased risk of permanent hearing loss.

9.1.1 Short-term and long-term health risks:

Low: Low for the majority of personnel on this site. Moderate for individuals working on/or near ship loading/unloading operations without proper hearing protection. This was reduced to Low with proper mitigation measures. All personnel are to have annual audiograms and enroll in Noise Medical Surveillance program #512 of the Hearing Conservation program (Reference 12).

9.2 Impulse:

While some potential for impulse noise could be associated with the industrial and ship loading and unloading operations at Shuaiba Port, the probability of impulse noise hazards is considered unlikely at Shuaiba Port.

9.2.1 Short-term and long-term health risks:

Not evaluated.

10 Unique Incidents/Concerns

10.1 Potential environmental contamination sources

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

10.2 Waste Sites/Waste Disposal:

All wastes are removed by contract personnel to Kuwait landfills/disposal sites for proper disposal per the Area Support Group – Kuwait, Department of Public Works (Reference 12).

10.2.1 Short-term and long-term health risks:

Low: Short-term and long-term health risk is low.

10.3 Fuel/petroleum products/industrial chemical spills

The OEHSA's Occupational Hazards Assessment indicates that many personnel at Shuaiba Port conducting ship loading/unloading operations may experience occasional exposures to hydraulic fluid and engine oil due to occasional leakage and maintenance. Hydraulic fluid contains small amounts of triorthocresyl phosphate (TOCP). The TOCP affects the neuromuscular system and it is readily absorbed through the skin. Based on small quantities, short duration, and infrequent exposure, this process does not require exposure monitoring at this time. Skin contact is considered minimal however all chemical solvents have the ability to de-fat the skin and repeated use may cause contact dermatitis. Latex gloves are not chemically resistant and due to the possible sensitization to latex, non-latex chemically resistant gloves were recommended. Also noted is the possible cleanup of

fuel/organic products – personnel conducting spill cleanup are advised to wear proper protection to mitigate exposure/contact (Reference 12).

10.3.1 Short-term and long-term health risks:

Low: The health risk is Moderate for individuals conducting specific operations without proper personal protection. Risk was reduced to Low with proper protection to mitigate exposure/contact.

10.4 Lead Based Paint

There is no specific information available to assess this hazard.

10.4.1 Short-term and long-term health risks:

Not evaluated: No data to support a health risk assessment.

10.5 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. Overall Pest control at Shuaiba Port is reported as excellent per the OEHSA (Reference 12).

10.5.1 Short-term and long-term health risks:

Low: Short-term and long-term health risks are Low. Confidence in the health risk assessment is medium.

10.6 Burn Pits

There are no known burn pits located on Shuaiba Port or the LSAs.

10.6.1 Short-term and long-term health risks:

None.

10.7 Asbestos

10.7.1 Short-term and long-term health risks:

Not evaluated: No data to support a health risk assessment.

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) 0028-07, Procedures for Deployment Health Surveillance, 2007.
4. USAPHC 2013 TG230: Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel. June 2013 Revision.
5. USAPHC 2002-2008 Military Deployment Periodic Occupational and Environmental Monitoring Summary (POEMS): Shuaiba Port, Kuwait.
6. USACHPPM 2008 Particulate Matter Factsheet; 64-009-0708, 2008.
7. 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.
8. Modification 12 to United States Central Command Individual Protection and Individual Unit Deployment Policy, 2 December 2013.
9. Armed Forces Pest Management Board: http://www.afpmb.org/content/venomous-animals-country-k#Kuwait. U.S. Army Garrison - Forest Glen, Silver Spring, MD.
10. Clinical Toxinology Resources: http://www.toxinology.com/. University of Adelaide, Australia.
11. 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.
12. Forward Deployed Preventive Medicine Unit (FDPMU). Occupational and Environmental Health Site Assessment (OEHSA), Al Shuaiba Port, Kuwait. 2 February 2009.
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[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.

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).
U.S. Army Public Health Command (USAPHC) Phone: (800) 222-9698. https://iphc.amedd.army.mil/Pages/Default.aspx
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 Force Health Protection and Readiness (FHP & R) Phone: (800) 497-6261. http://fhp.osd.mil