Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS): Sea Port of Debarkation/Embarkation (SPOD/E) including Camp Arifjan and Kuwait Naval Base, Shuaiba Port, Kuwait: 2002 to 2008

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 occupational and environmental health (OEH) risk for Sea Port of Debarkation/Embarkation (SPOD/E), Shuaiba Port, Kuwait and vicinity that includes Camp Arifjan and Kuwait Naval Base. 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 21 March 2002 through 31 December 2008 to include deployment OEH sampling and monitoring data (e.g., air, water, and soil), field investigation and health assessment reports, as well as country and area-specific information on endemic diseases.

This assessment assumes that environmental sampling for SPOD/E, 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 21 March 2002 through 31 December 2008.

The POEMS can be useful to inform healthcare providers and others of environmental conditions experienced by individuals deployed to SPOD/E 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, U.S. Forces utilized a portion of the Shuaiba Port Industrial Area as a SPOD/E. The SPOD/E transports heavy equipment in and out of the theater of operations. Army personnel were typically deployed to SPOD/E for one year; some Navy personnel are also deployed to this site for 6 months. Army personnel primarily conduct security/guard duties at SPOD/E, 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 SPOD/E (Camp Spearhead) was located within the Shuaiba Port Industrial Area. In early 2005, the Army closed the main base, Camp Doha, Kuwait and stated that the personnel from Camp Doha would be divided between Camp Arifjan and Camp Buehring. Current LSA's are located 20 – 40 km away at less industrialized locations. The primary LSA is Camp Arifjan, which houses over 80% of SPOD/E personnel. A few personnel including Navy personnel are housed at the LSA located at the Kuwait Naval Base (KNB).

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 SPOD/E 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 SPOD/E and vicinity that includes Camp Arifjan and Kuwait Naval Base:

Inhalable coarse particulate matter (PM_{10}); certain airborne chemical gases/vapors (e.g., $S0_2$, H_2S); food/waterborne diseases (e.g., diarrhea); other endemic diseases (leptosporsis and cutaneous leishmaniasis, Q-fever), and heat stress. For PM_{10} and chemical gases, certain sub groups amongst the deployed forces (e.g., those with pre-existing asthma/cardio pulmonary conditions) are at greatest risk of developing notable health effects. While for the most part any associated effects from the above should have resolved post-deployment, providers should be prepared to consider relationships to current complaints. Some individuals may have sought treatment for acute respiratory irritation during exposure incidents as described under the chemical pollutants section. Personnel who reported with symptoms or required treatment while at this site should have exposure/treatment noted in medical records/on SF600.The following may have caused acute health effects in some personnel *during deployment at* SPOD/E, Kuwait:

Long-term health risks & medical implications:

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

The only identified ambient OEH exposure resulting in potential risk of long term health effects is from inhalable fine particulate matter ($PM_{2.5}$). These exposures are documented and archived, but at this time no specific post-deployment evaluations, testing, or continued medical surveillance for personnel are recommended. However, providers should consider overall individual health status (e.g., any underlying conditions/susceptibilities) and potential unique individual exposures (such as occupational, or specific personal dosimeter data) when assessing individual concerns. As noted by the 2008 SPOD/E occupational hazards assessment, certain individuals may need to be followed/evaluated for specific occupational exposures/injuries (e.g., including annual audiograms for those enrolled in Noise Medical Surveillance of the Hearing Conservation program ; and personnel covered by Respiratory Protection program and/ or Hazardous Waste/Emergency Responders Medical Surveillance).

Table 2. Population-Based Health Risk Estimates – SPOD/E 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 microns in diameter (PM_{10})	Short-term: Variable, Low to High. Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: Variable, Low to High. Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).
	Long-term: No health guidelines		Long-term: No health guidelines
Particulate matter less than 2.5 microns in diameter ($PM_{2.5}$)	Short-term: Low. A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: Low. A majority of the time mild acute (short term) health effects are anticipated; certain peak levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.
	Long-term: Moderate. With repeated exposures it is considered possible that a small percentage of persons may have increased risk for developing chronic conditions, such as reduced lung function or exacerbated bronchitis, COPD, asthma or cardiopulmonary diseases. Personnel with a history of asthma or cardiopulmonary disease are at particular risk.		Long-term: Moderate. With repeated exposures it is considered possible that a small percentage of persons may have increased risk for developing chronic conditions, such as reduced lung function or exacerbated bronchitis, COPD, asthma or cardiopulmonary diseases. Personnel with a history of asthma or cardiopulmonary disease are at particular risk.
Metals	Short-term: None identified		Short-term: None identified
	Long-term: None to Low (for Aluminum)		Long-term: None to Low (for Aluminum)
Chemical Pollutants	Short-term: Variable, No risk (for Acrolein, Cl_2, NO_2), Low (for NH_3, CO, O_3) to Moderate (for H_2S, SO_2). Various organic and inorganic gases detected sporadically –at least occasional odors, irritation of eye/respiratory tract, possible headaches/nausea, asthma attacks		Short-term: Variable, No risk (for Acrolein, Cl_2, NO_2), Low (for NH_3, CO, O_3) to Moderate (for H_2S, SO_2). Various organic and inorganic gases detected sporadically –at least occasional odors, irritation of eye/respiratory tract, possible headaches/nausea, asthma attacks
	Long-term: No risk (for NO_2, CO, O_3, Cl_2) to Low (for Acrolein, H_2S, SO_2, NH_3)		Long-term: No risk (for NO_2, CO, O_3, Cl_2) to Low (for Acrolein, H_2S, SO_2, NH_3)

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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), 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) and Low (for typhus-murine, 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		Short-term: Moderate for leptospirosis.
	Long-term: None identified		Long-term: None identified
Respiratory	Short-term: Low (for tuberculosis and 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 and scorpions	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, Low to High. Risk of heat injury is High (for May – October), Low to Moderate for all other months.	Work-rest cycles, proper hydration and nutrition, and Wet Bulb Globe Temperature (WBGT) monitoring.	Short-term: Variable, Low to High. Risk of heat injury in unacclimatized or susceptible personnel is High (for May – October), Low to Moderate 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 frost bite.		Long-term: Low; Long-term health implications from cold injuries are rare but can occur, especially from more serious injuries such as frost bite.
NOISE			
Continuous	Short-term: None identified	Hearing protection used by personnel in higher risk areas	Short-term: None
	Long-term: Variable, Low to Moderate. Moderate risk to personnel working working near certain ship operations if no hearing protection used. Low risk to the majority of personnel working near major noise sources who wear proper hearing protection.		Long-term: Low
Impulse	Short-term: None identified		Short-term: None identified
	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]
Unique Incidents			
Waste Sites/Waste Disposal	Short-term: Low		Short-term: Low
	Long-term: Low		Long-term: Low
Fuel/petroleum products/ industrial chemical spills	Short-term: Low		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 SPOD/E 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 21 March 2002 through 31 December 2008. 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 SPOD/E 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 USAPHC/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 SPOD/E, Camp Arifjan, and KNB, Kuwait by Source

The following sections provide additional information about the OEH conditions summarized above. All risk assessments were performed using the methodology described in the U.S. Army Public Health Command 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

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

Personnel deployed to the SPOD/E 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 wind blown 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 SPOD/E 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.

Occasionally, 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). While the data is limited, the results validated reports of sulfur odors by showing that H_2S was routinely present above odor thresholds and frequently above levels that would have caused at least mild irritation effects/possible headaches/nausea. Occasional spikes for SO_2 and NH_3 also exceeded odor thresholds and mild effects levels. Chlorine results were not above health effect levels though a few very brief spikes exceeded the odor threshold. Even though some of these chemicals are not routinely sampled since they require specialized field equipment, some odors and effects similar to

those previously reported (e.g., eye irritation and burning) have continued to be anecdotally reported during more recent deployments. Thus, it is reasonable to assume these same types of industrial chemicals continue to be intermittently released at SPOD/E. The SO_2 and NH_3 were included in the calendar year (CY) 2004-CY2008 monitoring. No quantified data for Cl_2 or H_2S has been obtained since 2005 since they are not part of routine sampling efforts addressed by laboratory and the Mobile Ambient Air Monitoring Station (MAAMS). While no specific evidence of a unique release event has been reported, it is assumed that these industrial chemicals continue to be released intermittently at levels similar to those represented by the data obtained in 2004-2005, as discussed in the 'Chemical Pollutants (Gases and Vapors)' section below.

LSAs: While located 20 – 40 kilometers away, the LSAs (Camp Arifjan, Kuwait Naval Base) have similar windblown sand and dust conditions as SPOD/E 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 SPOD/E.

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 5).

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:

SPOD/E: The range of 24-hour PM_{10} concentrations in a total of 1914 samples from 21 March 2002 – 31 December 2008 was 24 $\mu g/m^3$ - 3485 $\mu g/m^3$ with an average concentration of 327 $\mu g/m^3$.

Arifjan: The range of 24-hour PM_{10} concentrations in 256 samples collected at Arifjan from 18 February 2003 – 23 September 2008 was 22 $\mu g/m^3$ - 4121 $\mu g/m^3$ with an average concentration of 332 $\mu g/m^3$.

KNB: The range of 24-hour PM_{10} concentrations in 82 samples collected at KNB from 19 July 2003 – 18 December 2007 was 50 µg/m^3 - 1671 µg/m^3 with an average concentration of 257 µg/m^3.

2.3.3 Short-term health risks:

Variable (Low to High). The short-term PM_{10} health risk assessment is Low to High based on average and peak PM_{10} sample concentrations, and the likelihood of exposure at these hazard severity levels. The variable risk is due to significant fluctuations in daily concentrations. Confidence in the short-term PM_{10} risk assessment was medium for Camp Arifjan and KNB to high for SPOD/E (Reference 4, Table 3-6).

SPOD/E: The short-term PM_{10} health risk is Low based on an average concentration of 327 µg/m^3 and High based on a peak concentration of 3485 µg/m^3. Daily risk levels for PM_{10} show no hazard for 69%, low risk for 18%, moderate risk for 6%, and high risk for 7% of the time

Camp Arifjan: The short-term PM_{10} health risk is Low based on an average concentration of 332 µg/m3 and High based on a peak concentration of 4121 µg/m^3. Daily risk levels for PM_{10} show no hazard for 63%, low risk for 17%, moderate risk for 7%, and high risk for 12% of the time.

KNB: The short-term PM_{10} health risk is Low based on an average concentration of 257 µg/m^3 and High based on a peak concentration of 1671 µg/m3. Daily risk levels for PM_{10} show no hazard for 77%, low risk for 6%, moderate risk for 9%, and high risk for 9% of the time.

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.

The hazard severity was negligible for average PM_{10} 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 3-10).

The hazard severity was critical for peak PM_{10} sample concentrations at all locations. During peak exposures at the critical hazard severity level, most if not all personnel will experience very notable eye, nose, and throat irritation and respiratory effects. Visual acuity is impaired, as is overall aerobic capacity. Some personnel will not be able to perform assigned duties. Some lost-duty days are expected. Those with a history of asthama or cardiopulmonary disease will experience more severe symptoms (Reference 4, Table 3-10).

2.3.4 Long-term health risk:

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

2.4 Particulate Matter, less than 2.5 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:

SPOD/E: A total of 64 valid $PM_{2.5}$ air samples were collected from 09 September 2005 – 16 March 2007. The range of 24-hour $PM_{2.5}$ concentrations was 3 µg/m^3 – 228 µg/m^3 with an average concentration of 56 µg/m^3.

Camp Arifjan: A total of 63 valid $PM_{2.5}$ air samples were collected from 22 September 2005 – 15 January 2007. The range of 24-hour $PM_{2.5}$ concentrations was 12 µg/m^3 – 166 µg/m^3 with an average concentration of 61 µg/m^3.

KNB: A total of 16 valid $PM_{2.5}$ air samples were collected from 27 October 2005 – 03 November 2005. The range of 24-hour $PM_{2.5}$ concentrations was 17 µg/m^3 – 68 µg/m^3 with an average concentration of 46 µg/m^3.

2.4.3 Short-term health risks:

Low. The short-term $PM_{2.5}$ health risk assessment is Low based on average and peak PM_{10} sample concentrations, and the likelihood of exposure at this hazard severity level. A Low health risk is expected little or no impact on accomplishing the mission (Reference 4, Table 3-3). Confidence in the short-term $PM_{2.5}$ health risk assessment was low for KNB to medium for SPOD/E and Camp Arifjan (Reference 4, Table 3-6).

SPOD/E: The short-term $PM_{2.5}$ health risk is Low based on an average concentration of 56 µg/m^3 and a peak concentration of 228 µg/m^3. Daily risk levels for $PM_{2.5}$ show no hazard for 75% and low risk for 25% of the time.

Camp Arifjan: The short-term $PM_{2.5}$ health risk is Low based on an average concentration of 61 µg/m^3 and a peak concentration of 166 µg/m^3. Daily risk levels for $PM_{2.5}$ show no hazard for 59% and low risk for 41% of the time.

KNB: The short-term $PM_{2.5}$ health risk is Low based on an average concentration of 46 µg/m^3 and a peak concentration of 68 µg/m^3. Daily risk levels for $PM_{2.5}$ show no hazard for 94% and low risk for 6% of the time.

The hazard severity was negligible for average and peak $PM_{2.5}$ sample concentrations at all locations. During 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 3-10).

2.4.4 Long-term health risks:

Moderate. The long-term $PM_{2.5}$ health risk assessment is Moderate based on average sample concentrations, and the likelihood of exposure at this hazard severity level. A Moderate health risk level suggests that long-term exposure to $PM_{2.5}$ is expected to require limited future medical surveillance activities and related resources (Reference 4, Table 3-3). Confidence in the long-term $PM_{2.5}$ health risk assessment was low for KNB to medium for SPOD/E and Camp Arifjan (Reference 4, Table 3-6).

The hazard severity was negligible for average $PM_{2.5}$ sample concentrations at all locations. With repeated exposures above the negligible hazard severity threshold, it is considered possible that a small percentage of personnel may have increased risk for developing chronic conditions, such as reduced lung function or exacerbated chronic bronchitis, COPD, asthma, atherosclerosis, or other cardiopulmonary diseases. Personnel 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 Aluminum MEG ($\mu g/m^3$)

- 14-day Negligible= 340
- 8-hour Negligible= 1000
- 1-hour Negligible= 5000

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

- 1-year Negligible= 3.4

2.5.2 Sample data/Notes:

SPOD/E: A total of 700 valid PM_{10} airborne metal samples were collected from April 2003 to August 2008. The range of PM_{10} concentrations for aluminum was 0.57 $\mu g/m^3$ – 26.5 $\mu g/m^3$ with and average concentration of 4.6 $\mu g/m^3$.

Camp Arifjan: A total of 253 valid PM_{10} airborne metal samples were collected from 18 February 2003 to 23 September 2008. The range of PM_{10} concentrations for aluminum was 0.35 $\mu g/m^3$ – 8.8 $\mu g/m^3$ with and average concentration of 4.8 $\mu g/m^3$.

KNB: A total of 82 valid PM_{10} airborne metal samples were collected from 19 July 2003 to 18 December 2007. All peak and average metals concentrations were below the short-term and long-term air MEGS.

2.5.3 Short-term health risks:

None identified. All PM_{10} airborne metal sample results were below the applicable short-term MEGS. Confidence in the short-term PM_{10} metals risk assessment was medium at KNB to high at SPOD/E and Camp Arifjan (Reference 4, Table 3-6).

2.5.4 Long-term health risks:

Low. The long-term PM_{10} airborne metals health risk assessment is Low based on average sample concentrations, and the likelihood of exposure at this hazard severity level. Confidence in the long-term PM_{10} metals risk assessment was medium at KNB to high at SPOD/E and Camp Arifjan (Reference 4, Table 3-6).

SPOD/E: The long-term PM_{10} airborne metals health risk is Low based on an average concentration of 4.6 µg/m^3 for aluminum.

Camp Arifjan: The long-term PM_{10} airborne metals health risk is Low based on an average concentration of 4.8 µg/m^3 for aluminum.

KNB: There was no long-term health risk from PM_{10} airborne metals since the average concentrations did not exceed the 1-year MEGs.

The hazard severity was negligible for average PM_{10} airborne metal sample concentrations at SPOD/E and Camp Arifjan.

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 H_2S MEGs (µg/m^3):

- 14-day Negligible= 460
- 1-hour Negligible=710
- 8-hour Negligible=460

Long-term H_2S MEG (µg/m^3):

- 1-year Negligible=14

Short-term CL_2 MEGs (µg/m^3):

- 14-day Negligible = 290
- 8-hour Negligible= 1500
- 1-hour Marginal = 5800

Long-term CL_2 MEG (µg/m^3):

- 1-year Negligible= 4.0

Long-term NH_3 MEG (µg/m^3):

Short-term NH_3 MEGs (µg/m^3):

- 14-day Negligible=7000
- 8-hour Negligible=21000
- 1-hour Marginal = 110000

- 1-year Negligible= 68.0

Short-term SO_2 MEGs (µg/m^3):

- 14-day Negligible=520
- 8-hour Negligible=520
- 1-hour Marginal= 2000
- 1-hour Critical= 79000

Long-term SO_2 MEG (µg/m^3):

- 1-year Negligible= 130

Short-term NO_2 MEGs (µg/m^3)

- 14-day Negligible= 940
- 8-hour Negligible= 940

Long-term NO_2 MEGs (µg/m^3)

- 1-year Negligible= 940

Short-term CO MEGs (µg/m^3)

- 14-day Negligible= 10000
- 8-hour Negligible= 290
- 1-hour Negligible= 950

Long-term CO MEGs (µg/m^3)

- 1-year Negligible= 7000

Short-term O_3 MEGs (µg/m^3)

- 14-day Negligible= 39
- 8-hour Negligible= 39
- 1-hour Negligible= 400

Long-term O_3 MEGs (µg/m^3)

- 1-year Negligible= 39

2.6.2 Sample data/Notes:

SPOD/E: A total of 135 air samples were collected from April 2003 – June 2008 and 43 air samples were analyzed for acrolein via the non-routine sampling equipment (e.g., T014 samplers). The maximum (peak) concentration for acrolein was 10 µg/m^3 and the average concentration was 1.4 µg/m^3. In addition, approximately 120 MiniWarn samples were collected from October 2004 – May 2005 for H_2S, Cl_2, NH_3, and SO_2. The maximum (peak) H_2S concentration was 6490 µg/m^3 with an average concentration of 1700 µg/m^3. The maximum (peak) Cl_2 concentration was 60 µg/m^3 with an average concentration of 3.0 µg/m^3. Sampes were also collected from the MAAMS from January 2004 – January 2008 for NO_2, CO, O_3, and SO_2. A total of 1305 air samples were collected and analyzed for NO_2. The maximum (peak) NO_2 concentration was 140 µg/m^3 with an average concentration of 50 µg/m^3. A total of 1474 air samples were collected and analyzed for CO. The maximum (peak) CO concentration was 36650 µg/m^3 with an average concentration of 880 µg/m^3. A total of 1479 air samples were collected and analyzed for O_3. The maximum (peak) O_3 concentration was 170 µg/m^3 with an average concentration of 36 µg/m^3. For the evaluation of SO_2 and NH_3, the

MAAMS data and MiniWarn data were combined. A total of 648 samples (MAAMS and MiniWarn combined) were collected and analyzed for NH_3. The maximum (peak) NH_3 concentration was 10700 µg/m^3 with an average concentration of 590 µg/m^3. A total of 1628 samples (MAAMS and MiniWarn combined) were collected and analyzed for SO_2. The maximum (peak) SO_2 concentration was 6420.

Camp Arifjan: A total of 5 air samples were collected from March 2004 to March 2005. No MAAMS or portable MiniWarn data are available for this location.

KNB: A total of 5 air samples were collected from January 2004 to March 2004. No MAAMS or portable MiniWarn data are available for this location.

2.6.3 Short-term health risks:

None to Moderate. The short-term health risk assessment is Variable based on average and peak chemical concentrations, and the likelihood of exposure at these hazard severity levels. Confidence in the short-term risk assessment for chemical pollutants was low for KNB and Camp Arifjan to high for SPOD/E (Reference 4, Table 3-6).

SPOD/E: The peak PEPC for acrolein (10 µg/m^3), Cl_2 (60 µg/m^3) and NO_2 (140 µg/m^3) did not exceed the 14-day Negligible MEG (46 µg/m^3, 290 µg/m^3, and 940 µg/m^3 respecitively), therefore, there is not an acute hazard.

The peak PEPC for H_2S (6490 µg/m^3) exceeded the 14-day Negligible MEG (460 µg/m^3), but did not exceed the 1-hour Marginal MEG (38000 µg/m^3); therefore, the hazard severity for H_2S is negligible. H_2S concentrations were consistently above the 14-day Negligible MEG from 24 October 2004 to 24 April 2005; therefore the hazard probability was elevated to frequent. The short-term health risk from H_2S is Moderate.

The peak PEPC for CO (36650 µg/m^3) exceeded the 14-day Negligible MEG (10000 µg/m^3), but did not exceed the 1-hour Negligible MEG (95000 µg/m^3); therefore, the hazard severity for CO is negligible. The hazard probability was seldom. Therefore, the short-term health risk from CO is Low.

The peak PEPC for O_3 (170 µg/m^3) exceeded the 14-day Negligible MEG (39 µg/m^3), but did not exceed the 1-hour Negligible MEG (400 µg/m^3); therefore, the hazard severity for O_3 is negligible. The hazard probability was seldom. Therefore, the short-term health risk from O_3 is Low

The peak PEPC for NH_3 (10700 µg/m^3) exceeded the 14-day Negligible MEG (7000 µg/m^3), but did not exceed the 1-hour Marginal MEG (110000 µg/m^3); therefore, the hazard severity for NH_3 is negligible. The hazard probability was seldom. Therefore, the short-term health risk from NH_3 is Low.

The peak PEPC for SO_2 (6420 µg/m^3) exceeded the 14-day Negligible MEG (520 µg/m^3), and the 1-hour Marginal MEG (2000 µg/m^3), but did not exceed the 1-hour Critical MEG (79000 µg/m^3). Therefore, the hazard severity is marginal. The hazard probability was occasional. Therefore, the short-term health risk from SO_2 is Moderate.

Camp Arifjan: All chemical concentrations were below the short-term MEGs; therefore, no acute hazards were present.

KNB: All chemical concentrations were below the short-term MEGs; therefore, no acute hazards were present.

2.6.4 Long-term health risks:

None to Low. The long-term health risk assessment is Low 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 low at KNB and Camp Arifjan to high at SPOD/E (Reference 4, Table 3-6).

SPOD/E: The average concentration for acrolein (1.0 µg/m^3) exceeded the 1-year Negligible MEG (0.14 µg/m^3). The hazard severity for acrolein is negligible. The hazard probability is seldom. The long-term health risk from acrolein is Low.

The average concentration for H_2S (1700 µg/m^3) exceeded the 1-year Negligible MEG (14 µg/m^3). The hazard severity for H_2S is marginal. The hazard probability is seldom. It should be noted that H_2S concentrations do not represent continuous daily year long exposure levels. The long-term health risk from H_2S is Low.

The average concentration for Cl_2 (3 µg/m^3), CO (880 µg/m^3), NO_2 (50 µg/m^3), and O_3 (36 µg/m^3) did not exceed the 1-year Negligible MEG (4 µg/m^3, 7000 µg/m^3, 940 µg/m^3, and 39 µg/m^3 respectively); therefore, there is not a chronic hazard.

The average concentration for NH_3 (590 µg/m^3) exceeded the 1-year Negligible MEG (68 µg/m^3). The hazard severity for NH_3 is marginal. The hazard probability was seldom. It should be noted that NH_3 concentrations do not represent continuous daily year long exposure levels. The long-term health risk from NH_3 is Low.

The average concentration for SO_2 exceeded the 1-year Negligible MEG (130 µg/m^3). Since the overall average was above the 1 year MEG, the chronic severity is estimated marginal. However, the concentrations do not represent continuous daily year long exposure levels so the probability of exposure for this chronic effect severity is considered seldom. CY2008 MAAMS data supports this estimate. The long-term health risk from SO_2 is Low.

Camp Arifjan: All chemical concentrations were below the long-term MEGs; therefore, no chronic hazards were present.

KNB: All chemical concentrations were below the long-term MEGs; therefore, no chronic hazards were present.

3 Soil

3.1 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.

SPOD/E: A total of 34 soil samples were collected from 08 November 2002 – 08 November 2008.

Camp Arifjan: A total of 26 soil samples were collected from 09 April 2001 – 25 February 2008.

KNB: A total of 25 soil samples were collected from 15 July 2003 – 13 September 2004.

3.1.1 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.

3.1.2 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. Bottled water is the primary potable water source for all deployed personnel in Kuwait. All brands of bottled water are approved through the Army Medical Veterinary service. All bottle water brands and each lot of bottled water is tested monthly by both the Army Medical Veterinary service and the environmental division of CSA contracting company. Monitoring includes total coliform presence/absence and *E. coli*.

Desalinated seawater is the primary source of tap water in Kuwait. Local Kuwaiti municipal water supplies are used for personal hygiene, cooking, and some secondary drinking (e.g., ice/vending). According to Department of Public Works (DPW) Environmental Officers, this water is filtered and treated to meet Kuwaiti EPA standards. This water is used by local residents as their primary drinking water. This water feeds the main water lines into SPOD/E and is piped throughout the camp. Routine testing of tap water is conducted monthly by both the Army Medical Veterinary service and the environmental division of CSA contracting company. Monitoring includes total coliform presence/absence and *E. coli*. Tap water may become contaminated during distribution because of aging or corroded pipes, poor system integrity, pressure fluctuations from power shortages causing back siphoning, and subsequent microbial or chemical infiltration. A complete assessment of the Kuwait water distribution system is not possible due to access and travel restrictions. However some laboratory analyses of treated water samples has been used to enhance routine field monitoring.

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 drinking water for up to 365 days (1-year).

4.1.2 Sample data/Notes:

SPOD/E: A single water sample was collected on 5 June 2004. No chemicals were detected at levels above the short and long-term MEGs.

Camp Arifjan: A total of nine water samples were collected from 13 May 2004 – 5 November 2007 and were evaluated for this health risk assessment. No chemicals were detected at levels above the short and long-term MEGs.

KNB: A total of six water samples were collected from 13 May 2004 – 24 October 2006 and were evaluated for this health risk assessment. Most chemicals were detected at levels below the short and long-term MEGs; however, copper exceeded the short-term MEG in one sample.

4.1.3 Short-term health risk:

None identified based on available sample data. No health risks from drinking water exposures were identified at SPOD/E and Camp Arifjan based on the available data. At KNB, the peak PEPC for copper (0.074 mg/L) was detected slightly above the 14-day 15 L/day Negligible MEG (0.047 mg/L) in 1 water sample collected from a water distribution system. However, this was considered a secondary drinking water sample, so the 14-day 5L/day MEG would be the most appropriate MEG to use in this evaluation. The peak PEPC for copper did not exceed the 14-day 5L/day MEG (0.14 mg/L); therefore, copper is not a health concern.

4.1.3 Long-term health risk:

None identified based on available sample data. No health risks from drinking water exposures were identified based on the available data.

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

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.

4.2.1 Site-Specific Sources Identified

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 these locations 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).

SPOD/E: A total of five water samples were collected from 21 June 2003 – 11 October 2006 and were evaluated for this health risk assessment. No chemicals were detected at levels above the short or long-term MEGs.

Camp Arifjan: A total of 24 water samples were collected from 30 October 2002 – 15 October 2008 and were evaluated for this health risk assessment. No chemicals were detected at levels above the short or long-term MEGs.

KNB: A total of four water samples were collected from 18 February 2003 – 30 July 2007 and were evaluated for this health risk assessment. No chemicals were detected at levels 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 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 3), or the Military Exposure Surveillance Library (MESL) from 21 March 2002 - 31 December 2008 timeframe (Reference 6)

5.2 Depleted Uranium (DU):

No specific hazard sources were documented in the DOEHRS, or MESL from 21 March 2002 - 31 December 2008 timeframe.

5.3 Ionizing Radiation:

No specific hazard sources were documented in the DOEHRS, or MESL from 21 March 2002 - 31 December 2008 timeframe.

5.4 Non-Ionizing Radiation:

No specific hazard sources were documented in the DOEHRS, or MESL from 21 March 2002 - 31 December 2008 timeframe.

6 Endemic Disease[1]

This document lists the endemic diseases reported in the region, its specific health risks and severity and general health information about the diseases. Reference 7 was primarily utilized to obtain the necessary information for this section. USCENTCOM MOD 11 (Reference 8) lists deployment requirements, to include immunizations and chemoprophylaxis, in effect during the timeframe of this POEMS.

6.1 Foodborne and Waterborne Diseases

Food borne and waterborne diseases in the area are transmitted through the consumption of local food and water. Local unapproved food and water sources (including ice) are heavily contaminated with pathogenic bacteria, parasites, and viruses to which most U.S. Service Members have little or no natural immunity. Effective host nation disease surveillance does not exist within the country. Only a small fraction of diseases are identified or reported in host nation personnel. Diarrheal diseases are expected to temporarily incapacitate a very high percentage of U.S. personnel within days if local food, water, or ice is consumed. Hepatitis A and typhoid fever infections typically cause prolonged illness in a smaller percentage of unvaccinated personnel. Vaccinations are required for DOD personnel and contractors. In addition, although not specifically assessed in this document, significant outbreaks of viral gastroenteritis (e.g., norovirus) and food poisoning (e.g., *Bacillus cereus*, *Clostridium perfringens*, *Staphylococcus*) may occur. Key disease risks are summarized below:

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

6.1.1 Diarrheal diseases (bacteriological)

High, mitigated to Low: Diarrheal diseases 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

[1] NOTE: "Risk" level refers to both severity of disease (without controls, for example vaccinations) and probability of disease based on local rates/endemic status. Diseases described are those presenting greater risk when compared with U.S. conditions. Most identified disease risks can and are being mitigated with military preventive medicine measures/policies.

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 SPOD/E 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 no risk (for Hepatitis A and Typhoid fever). Additionally, U.S. Forces are provided food and water from approved sources. Confidence in risk estimate is high (Reference 4, Table 3-6).

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 sand flies. 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-murine (fleaborne)

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

6.2.5 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), and Low for typhus-murine, 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 high (Reference 4, Table 3-6).

6.2.7 Long-term health risks:

Low: Low (for the visceral [chronic] leishmaniasis). Confidence in the risk estimate is high (Reference 4, Table 3-6).

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. Risk was restricted primarily to areas along rivers and lakes. These diseases can debilitate personnel for up to a week or more. Leptospirosis risk typically increases during flooding. In addition, although not specifically assessed in this document, bodies of surface water are likely to be contaminated with human and animal waste. Activities such as wading or swimming may result in exposure to enteric diseases including diarrhea and hepatitis via incidental ingestion of water. Prolonged water contact also may lead to the development of a variety of potentially debilitating skin conditions including bacterial or fungal dermatitis. Mitigation strategies were in place and included avoiding water contact and recreational water activities, proper wear of uniform (especially footwear), and protective coverings for cuts/abraded skin.

6.3.1 Leptospirosis

Moderate, mitigated to Low: 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, Leptospirosis present in the soil pass directly into surface waters. Leptospirosis 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 SPOD 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.

6.3.2 Short-term health risks:

Low: Unmitigated health risk of leptospirosis is Moderate during warmer months. Mitigation measures reduce the risk to Low. Confidence in the health risk estimate is high (Reference 4, Table 3-6).

6.3.3 Long-term health risks:

None identified based on available data.

6.4 Respiratory Diseases

Although not specifically assessed in this document, deployed U.S. forces may be exposed to a wide variety of common respiratory infections in the local population. These include influenza, pertussis, viral upper respiratory infections, viral and bacterial pneumonia, and others. The U.S. military populations living in close-quarter conditions are at risk for substantial person-to-person spread of respiratory pathogens. Influenza is of particular concern because of its ability to debilitate large

numbers of unvaccinated personnel for several days. Mitigation strategies were in place and included routine medical screenings, vaccination, enforcing minimum space allocation in housing units, implementing head-to-toe sleeping in crowded housing units, implementation of proper Personal Protective Equipment (PPE) when necessary for healthcare providers and detention facility personnel.

6.4.1 Tuberculosis (TB)

Moderate, mitigated to Low: 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). Overall risk was reduced to Low with mitigation measures. Confidence in the risk estimate is high (Reference 4, Table 3-6).

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 SPOD/E 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 high (Reference 4, Table 3-6).

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 Clinical Toxinology Resources web site from the University of Adelaide, Australia (Reference 9). The species listed below have home ranges that overlap the location of SPOD/E 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 ther 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, but death from constriction possible, but rare.

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

7.3.1 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., *A. crassicauda*). See effects of venom above. Mitigation strategies included avoiding contact, proper wear of uniform (especially footwear), and timely medical treatment. Confidence in the health risk estimate is low (Reference 4, Table 3-6).

7.3.2 Long-term health risks:

None identified.

8 Heat/Cold Stress

8.1 Heat

Summer (May through October) exhibits 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 18ºF. 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 10). 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 (Reference 4, Table 3-6).

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 (Reference 4, Table 3-6).

8.2 Cold

Winter (Nov through April) exhibits 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. 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 (Reference 4, Table 3-6).

9 Noise

9.1 Continuous:

Ship loading and unloading operations at the SPOD/E create outdoors noise levels that occasionally fluctuate above the threshold level requiring single-level hearing protection (85dBA). This occurrence was documented in the Occupational and Environmental Health Site Assessment (OEHSA) and certain personnel (e.g., forklift operators etc) did not have proper hearing protection (Reference 11). 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 SPOD/E 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 11).

9.2 Impulse:

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

9.2.1 Short-term and long-term health risks:

The risk from impulse noise hazards at SPOD/E is considered Low.

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, DPW (Reference 11).

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 SPOD/E 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). 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 are possible clean up of fuel/organic products – personnel conducting spill cleanup are advised to wear proper protection to mitigate exposure/contact (Reference 11).

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 data portal. Overall Pest control at SPOD/E is reported as excellent per the OEHSA (Reference 11).

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 (Reference 4, Table 3-6).

10.6 Burn Pits

There are no known burn pits located on SPOD/E.

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[2]

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

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

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

4. USAPHC (Prov) 2010 TG230: Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel. June 2010 Revision.

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

6. 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.

7. National Center for Medical Intelligence (NCMI) is at https://www.intelink.gov/ncmi/index.php.

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

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

10. 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.

11. Forward Deployed Preventive Medicine Unit (FDPMU). Occupational and Environmental Health Site Assessment (OEHSA), Seaport of Debarkation (SPOD), Al Shuaiba Port, Kuwait. 2 February 2009.

[2] NOTE. The data are currently assessed using the TG230 2010. The general method involves an initial review of the data, which eliminates all chemical substances not detected above 1-yr 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 risk). This is performed by deriving separate short-term and long term population exposure level 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 non-drinking 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