Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Ahmed Al Jaber Air Base and Vicinity, Kuwait
Calendar Years: (January 2003 to July 2018)

AUTHORITY: This Periodic Occupational and Environmental Monitoring Summary (POEMS) has been developed in accordance with Department of Defense (DoD) Instructions 6490.03, 6055.05, and JCSM (MCM) 0028-07, *See REFERENCES.*

PURPOSE: This POEMS documents the Department of Defense (DoD) assessment of Occupational and Environmental Health (OEH) risk for Ahmed Al Jaber Air Base and Vicinity, Kuwait. It includes Ahmed Al Jaber Air Base, Kuwait and other military camps in in the immediate vicinity where US Personnel lived or worked. It presents a qualitative estimate of population-based health risks identified at this location and their potential medical implications. This report has been updated based on information collected from 15 January 2018 through 24 July 2018 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. While the assessment is for this time period, use of samples before this rotation may be used to determine hazard characterization, confidence in controls and any potential trends.

This assessment assumes that environmental sampling at Ahmed Al Jaber Air Base, Kuwait 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 January 2003 through July 2018.

The POEMS can be useful to inform healthcare providers and others of environmental conditions experienced by individuals deployed to Ahmed Al Jaber Air Base and the local 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 in their medical record on a Standard Form (SF) 600 (Chronological Record of Medical Care).

Health protective exposure assumptions are used in the assessment of all health risks, i.e. the resident population is assumed to be constantly exposed to environmental conditions. Small groups of personnel assigned to Ahmed Al Jaber Air Base or the local vicinity addressed in this summary may be at greater risk than the general population due to operational requirements; these groups are identified when appropriate.

SUMMARY: Conditions with an estimated health risk of Moderate or greater are summarized in Table 1. Table 2 provides population based risk estimates for identified OEH conditions at Ahmed Al Jaber Air Base and/or camps in the vicinity, Kuwait. 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. *Navigable links have been imbedded in both tables and the discussion sections of the POEMS so that the reader can easily move back and forth between the summary tables and detailed discussions.*

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

Short-term health risks & medical implications:

Exposures associated with the following environmental stressors may be associated with potential acute health effects in some personnel during deployment at Ahmed Al Jaber Air Base that includes all areas of Ahmed Al Jaber Air Base and the local vicinity, Kuwait:

Air Quality: PM2.5 (Moderate Risk). Exposures may result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel while at this site. 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.

Food/Waterborne Diseases: Diarrhea-bacterial (High Risk). For personnel that consume non-approved local food, ice or water, there is a varying potential for food/waterborne diseases. Risks from food/waterborne diseases should be reduced with preventive medicine controls and mitigation, only drinking from approved water sources and eating from approved food sources in accordance with standing CENTCOM policy year round.

Respiratory Diseases: Tuberculosis (Low risk per NCMI assessment). Personnel in close-quarter conditions could have been at risk for person-to-person spread.

Animal Contact Diseases: Q fever (Intermediate risk per NCMI assessment). For venomous animals (vipers, scorpions) and insects, effects of venom vary with species from mild localized swelling to potential lethal effects; risks reduced by avoiding contact and proper and timely treatment.

Heat Stress: (Variable Risk) Risk can be greater for susceptible persons including those older than 45, of low fitness level, un-acclimatized, or with underlying medical conditions. Risks from heat stress may be reduced with preventive medicine controls, work-rest cycles, and mitigation.

Hazardous Noise: Continuous noise (Moderate Risk). Hazardous noise sources are common on AJAB, especially in flight line areas. Those operating hazardous equipment should use appropriate PPE. There is a moderate risk of temporary threshold shifts if proper controls are not followed.

Special Incidents/Spills: UXOs (High Risk). Potential for UXOs left over from the Gulf War in the 1990s era. Areas are appropriately marked with UXO warning signage. Numerous UXOs have been discovered across the installation, particularly outside of the LSA area from Nov 2014 - Jan 2016.

Long-term health risks & medical implications:

Exposures associated with the following environmental stressors may be associated with potential chronic health effects in some personnel during deployment at Ahmed Al Jaber Air Base and the local vicinity:

Air Quality: PM2.5 (Moderate Risk). Fine particulate matter less than 2.5 micrometers in diameter (PM2.5) are present in the air in AJAB at moderate concentrations based on sample data collected. Individuals who routinely worked outdoors during this period and inhaled PM2.5 at levels present at the base may have developed health conditions such as chronic bronchitis, reduced lung function and asthma. Individuals with a history of asthma or pre-existing cardiopulmonary disease are likely at greater risk. There are no specific recommended post-deployment medical surveillance evaluations for individuals with particulate exposures. Providers should consider individual health status (e.g., any underlying conditions/susceptibilities) and unique individual OEH exposures (i.e. welding fumes) when addressing individual concerns. Although short-term effects from exposure to dust should have resolved, there are potential long-term health effects; providers should consider the relationship between potential deployment exposures and current complaints.

Heat Stress: (Moderate Risk). NIOSH reports that certain heart, kidney, and liver damage are thought by some researchers to be linked to long-term heat exposure. However, the evidence supporting these associations is not conclusive. Heat exposure has been associated with temporary infertility in both women and men, with the effects being more pronounced in men. Sperm density, motility, and the percentage of normally shaped sperm can decrease significantly when the temperature of the groin is increased above a normal temperature.

Hazardous Noise: Continuous Noise (Moderate Risk). Hazardous noise sources are common on AJAB, especially in flight line areas. Those operating hazardous equipment should use appropriate PPE. There is a moderate risk of permanent threshold shifts if proper controls are not followed.

Special Incidents/Spills: UXOs (High Risk). Potential for UXOs left over from the Gulf War in the 1990s era. Areas are appropriately marked with UXO warning signage. Numerous UXOs have been discovered across the installation, particularly outside of the LSA area from Nov 2014 - Jan 2016.

Table 2: Population-Based Health Risk Estimates – Ahmed Al Jaber Air Base and Vicinity - Kuwait [1, 2]

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented[5]	Residual Health Risk Estimate[4]
Air			
Particulate matter less than 10 microns in diameter (PM_{10}) (see paragraph 2.3)	Short-term: **Low** Daily levels vary; acute health effects (e.g., upper respiratory tract irritation) are more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).	Most personnel live and work in air conditioned buildings or tents for comfort purposes. For those not working in air condition spaces, minimize time outdoors, and keep doors or tent flaps closed.	Short-term: **Low** Insufficient data exist upon which to base a health risk assessment. Based on current Data gathering is on-going.
	Long-term: Health guidelines are not defined.		Long-term: Health guidelines not defined.
Particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) (see paragraph 2.4)	Short-term: **Low** No acute health effects to the eye, nose, or throat irritation from exposure were anticipated to have occurred during this deployment. Existing medical conditions (e.g., asthma or respiratory diseases) may be exacerbated for a small segment of the deployed population	Limit strenuous physical activities when air quality is poor, minimize time outdoors, and keep doors, windows and tent flaps closed. Those with a history of asthma or pre-existing cardiopulmonary disease have a higher risk for developing these chronic conditions and should implement due control measure diligence.	Short-term: **Low** [For particulate matter ($PM_{2.5}$), control measures have limited efficacy. Thus the residual risk may be similar or identical to unmitigated risk.]
	Long-term: **Moderate** A small percentage of individuals may be at increased risk of developing chronic health conditions.		Long-term: **Moderate** (For particulate matter (PM), control measures have limited efficacy. Thus the residual risk may be similar or identical to unmitigated risk.
Airborne Metals (see paragraph 2.5)	Short-Term: **Low** Based on the samples and associated exposure information assessed, no metals were identified as an acute hazard. Long-term: **Low**; Based on the samples and associated exposure information assessed, no metals were identified as a chronic hazard.	Strenuous physical activities limited when air quality is poor; windows and doors are closed.	For metals associated with ambient dust, control measures have limited efficacy. Thus the residual risk may be similar or identical to unmitigated risk. Short-term: **Low** Long-term: **Low**
Volatile Organic Compounds (VOC) (see paragraph 2.6)	Short-term: **Not Evaluated** No quantitative data exists. However, qualitative evaluation indicates VOCs are not a general concern. Except for in the possible case of incident response.	Clean up fuel spills quickly, if they occur.	Short-term: **Not Evaluated;** Insufficient data exists upon which to base a final health risk assessment.
	Long-term: **Not Evaluated** No quantitative data exists. However, qualitative evaluation		Long-term: **Not Evaluated** Insufficient data exists upon which to base a final health risk assessment.

Table 2: Population-Based Health Risk Estimates – Ahmed Al Jaber Air Base and Vicinity - Kuwait [1, 2]

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented[5]	Residual Health Risk Estimate[4]
	indicates VOCs are not a general concern.		
Soil			
Soil (see paragraph 3)	Short-Term: **Low** Currently, soil sampling quantitative data is not evaluated. There are no plans to do this unless requested**.** Long-term: **Low** Currently, soil sampling quantitative data is not evaluated. There are no plans to do this unless requested**.**	Fuel spills cleaned up quickly when they occur. After any spills, contaminated soil will be removed by contractor to an off base location.	Short-Term: **Moderate** Long-term: **Low**
Water			
Consumed Water (Water Used for Drinking) (see paragraph 4.2)	Short-term: **Low** U.S. Army Veterinarian Service approved bottled water and packaged water from the Expeditionary Water Packaging System was provided for drinking. No analyte was detected above the 14 day 15L/day negligible drinking water military exposure guidelines.	U.S. Army Veterinary Service approved bottled water and Preventive Medicine/ Army Veterinary approved packaged water were supplied and consumed except for a brief period during the onset of the war. Active and ongoing drinking water surveillance program.	Short-term: **Low**
	Long-term: **Low** U.S. Army Veterinarian Service approved bottled water and packaged water from the Expeditionary Water Packaging System were provided for drinking. No analyte was detected above the 14 day 15L/day negligible drinking water military exposure guidelines.		Long-term: **Low**
Water used for other purposes (non-drinking) (see paragraph 4.3)	Short-term health risk: **Low**	Water surveillance programs which routinely monitor for disinfectant residual and bacteriological contamination	Short-term: **None**
	Long-term health risk: **Low**		Long-term: **None**
Military Unique			
Chemical Biological, Radiological Nuclear (CBRN) Weapons (see paragraph 5.1)	Short-term: **Low**		Short-term: **Low**
	Long-term: **Low**		Long-term: **Low**
Depleted Uranium (DU) (see paragraph 5.2)	Short-term: **Low**	Storage in controlled area. Rotational audits are performed on the permit.	Short-term: **Low**
	Long-term: **Low**		Long-term: **Low**
Ionizing Radiation (see paragraph 5.3)	Short-term: **Low**	Area surveys are performed and radiation workers are	Short-term: **Low**
	Long-term: **Low**		Long-term: **Low**

Table 2: Population-Based Health Risk Estimates – Ahmed Al Jaber Air Base and Vicinity - Kuwait [1, 2]			
Source of Identified Health Risk[3]	**Unmitigated Health Risk Estimate[4]**	**Control Measures Implemented[5]**	**Residual Health Risk Estimate[4]**
		enrolled in the dosimetry program.	
Non-ionizing Radiation (see paragraph 5.4)	Short-term: **Low**	Position antennas so they are only accessible to trained individuals.	Short-term: **Low**
	Long-term: **Low**		Long-term: **Low**
Endemic Disease			
Gastrointestinal (same as Food borne/Waterborne (e.g., diarrhea-bacteriological) (see paragraph 6.2)	Short-term: **High** If ingesting unapproved local food/water, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (hepatitis A, typhoid fever, brucellosis, hepatitis E). Viral gastroenteritis can present due to a high rate of personnel turnover and shared dining, berthing, bathroom facilities, and working spaces.	Standard Preventive Medicine measures: Hand washing, immunizations (hepatitis A and typhoid fever), the consumption of food and water from approved sources, and habitability inspections to ensure cleanliness/sanitation.	Short-term: **Moderate** Based on disease incident reporting from Kuwait, bacterial and protozoal gastrointestinal diseases, cholera, brucellosis, and hepatitis E infections present a low risk. Noro Virus and other potential risk have been mitigated effectively through implementation of adequate hygiene practices.
	Long-term: **Low.** The majority of gastrointestinal diseases do not cause prolonged illness.		Long-term: **Low** Based on disease incident reporting from Kuwait.
Arthropod Vector Borne (see paragraph 6.3)	Short-term: **Low** Competent vectors and reservoirs for disease are present. Risk is for Leishmaniasis (cutaneous), sandfly fever, West Nile fever, Crimean-Congo hemorrhagic fever, rickettsioses (tick-borne spotted fever group and murine typhus) and Sindbis**.**	Standard Preventive Medicine measures: proper wearing of insecticide-treated uniforms and the application of insect repellent to the skin, chemoprophylaxis in accordance with COCOM policy (i.e., malaria), removal of vector harborages within camps, and the application of pesticides.	Short-term: **Low** Based on efficacy of control measure as evidenced by lack of disease(s) reported in various medical surveillance data bases e.g., TMDS, MERS, DRSi.
	Long-term: **Low** It is possible to be infected during deployment with leishmaniasis, but not to have clinically evident disease until redeployed.		Long-term: **Low** Based on disease incident reporting from Kuwait.
Water-Contact (e.g. wading, swimming) (see paragraph 6.4)	Short-term: **Low**.	Avoidance of fresh water sources, such as puddles/ standing water, drainage areas, etc. Treatment (primarily chlorination) process for non-drinking water (water used for bathing, cooking, etc.).	Short-term: **Low** Based on disease incident reporting from Kuwait. Based on efficacy of control measure as evidenced by lack of disease(s) reported in various medical surveillance data bases e.g., TMDS, MERS, DRSi.
	Long-term: **None**		Long-term: **None**

Table 2: Population-Based Health Risk Estimates – Ahmed Al Jaber Air Base and Vicinity - Kuwait [1, 2]

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented[5]	Residual Health Risk Estimate[4]
Respiratory (see paragraph 6.5)	Short-term: **Low** for TB **Low** for upper respiratory infections such as influenza.	Influenza immunizations are given either before or during deployment. Local and third country national workers/contractors are required to complete health screening prior to employment. Potential tuberculosis exposure is addressed in the Post Deployment Health Assessment.	Short-term: **Low** for upper respiratory infections and tuberculosis. Based on efficacy of control measure as evidenced by lack of disease(s) reported in various medical surveillance data bases e.g, TMDS, MERS, DRSi.
	Long-term: **Low**. The majority of respiratory diseases do not cause prolonged illness.		Long-term: **Low** Based on disease incident reporting from Kuwait.
Animal Contact (see paragraph 6.6	Short-term: **Low to Moderate.** There are a significant number of vectors within the living areas. Q-fever is rated as **moderate** risk. Rabies and anthrax based on disease incident reporting from Kuwait is **low**.	Standard Preventive Medicine measures, as well as COCOM policy, generally prohibit contact with, adoption, or feeding of feral animals. Immunizations for anthrax and rabies (rabies vaccination and/or immune globulin given if clinically directed).	Short-term: **Low to Moderate** Q-fever is rated as **moderate** risk. Rabies and anthrax based on disease incident reporting from Kuwait is **low**.
	Long-term: **Low** Based on disease incident reporting from Kuwait.		Long-term: **Low** Based on disease incident reporting from Kuwait.
Venomous Animal/ Insects			
Snakes, scorpions, and spiders (see paragraph 7)	Short-term: **Low** Based on disease incident reporting from Kuwait.	Standard Preventive Education on how to avoid them (shake out boots before donning, etc.), reduce the risk of exposure. No anti-venom is available at this location and cannot be implemented until a critical care treatment capability is established in order to adequately treat side-effects of the anti-venom/venin.	Short-term: **Low.** The installation has a significant infestation of scorpions, snakes, and spiders as the base was dormant and people moved in over the already existing scorpion, snake, and spider population.
	Long-term: **Low**		Long-term: **Low**
Heat/Cold Stress			
Heat (see paragraph 8.2)	Short-term: **Variable** Risk of heat injury in summer months (of. May-September) for un-acclimatized personnel.	Adequate periods of acclimatization for newly reporting or returning personnel. Adjustment of work-rest cycles based on monitoring of climatic conditions.	Short-term: **Variable.** Based on efficacy of control measure and incidence of heat/cold injury(ies) reported in various medical surveillance data bases e.g, TMDS, MERS, DRSi.
	Long-term: **Low**		Long-term: **Low**

Table 2: Population-Based Health Risk Estimates – Ahmed Al Jaber Air Base and Vicinity - Kuwait [1, 2]			
Source of Identified Health Risk[3]	**Unmitigated Health Risk Estimate[4]**	**Control Measures Implemented[5]**	**Residual Health Risk Estimate[4]**
Cold (see paragraph 8.3)	Short-term: **Low** No cold injury data were available in the DOEHRS or MESL for any of the camps covered in this assessment. Accordingly, risk estimates are based strictly on existing climatologic data The risk for cold stress/injuries is largely dependent on clothing/equipment worn, operational work intensity and individual factors rather than environmental factors alone.	Provision of adequate foul weather clothing Appropriate work/rest cycles during cold weather	Short-term: **Low**
	Long-term: **Low**		Long-term: **Low**
Noise			
Noise (Continuous) (Flightline, Power Production) (see paragraph 9.1)	Short-term: **Moderate** Sources of potential noise include flight line operations, associate with both fixed and rotary wing aircraft, tactical generators and various hand tools in maintenance shops.	Use of hearing protection. Labeling noise hazardous areas. Leadership enforcement of compliance with available PPE.	Short-term: **Low** Tremendous effort is made to ensure hearing loss is neither permanent nor temporary as a result of deployment exposure. Sources of potential noise include flight line operations, associate with both fixed and rotary wing aircraft, tactical generators and various hand tools in maintenance shops. Due to the inherent noise hazards in flight line operations, personnel were required to wear dual hearing protection.
	Long-term: **Moderate**		Long-term: **Low**
Impulse (see paragraph 9.2)	Short-term: **Low** No sources of impulse noise are present.		Short-term: **Low** No sources of impulse noise are present.
	Long-term: **Low**		Long-term: **Low**
Unique Concerns			
Special Incidents or Spills: (see paragraph 10.1)	Short and Long term: **High** There are two dirt mounds along munitions road known to have the potential for containing UXOs left over from the Gulf War. During Jul 15-Jan 16 rotation, DU projectiles were found in these mounds. UXOs were found near the waste lagoon around 15 Jan, 16.	UXO areas were appropriately marked with warning signage. November 2014 Incident: Fire Dept. was able to contain spill area and clean up. May 2015 Incident: The area of contaminated sand was shoveled into palletized box crates and removed for disposal. CE maintained	Short and Long term: **No data available**

Table 2: Population-Based Health Risk Estimates – Ahmed Al Jaber Air Base and Vicinity - Kuwait [1, 2]

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented[5]	Residual Health Risk Estimate[4]
		oversight of the cleanup and then URS provided removal and oversight of the palletized dirt-filled crates.	
Waste Sites/Waste Disposal (see paragraph 10.2)	Short-term: **Low;** Based on available data. Long-term: **Low;** Based on available data.	Base personnel have minimal contact with waste. Four sources of waste exist on base: 1) medical, 2) non-hazardous solid waste, 3) hazardous industrial waste, and 4) sanitary sewer/latrine waste.	Short-term: **Low,** Based on available data. Long-term: **Low,** Based on available data.
Potential Environmental Contamination Sources: (see paragraph 10.3)	There may be occupational exposure pathways associated with aircraft, vehicle and site maintenance. Typical chemicals of concern associated with potential occupational exposures were petroleum, oils, and lubricants. No industrial hygiene data exist to document the significance of occupational exposures; however, there were typically procedures in place for storage, handling, use and disposal of hazardous materials which generally minimize health risk.	Knowledge of the U.S. Central Command and Service specific policies and procedures served as the basis of this risk assessment	Short-term (acute) and Long-term (chronic) health risks: **Not Evaluated** - No data were available upon which to base a risk assessment specific to Ahmed Al Jaber Air Base, Kuwait
Pesticides/Pest Control (see paragraph 10.4)	Long and Short-term: **Low** The integrated pest management plan emphasizes non-chemical control over the use of chemical pesticides. During this rotation the potential for base residents to come in contact with improperly formulated insecticides is remote.	See Section 10.4	Long and Short-term: **None** Identified based on available data
Asbestos (see paragraph 10.5)	Long and Short-term: **Low** Based on available data	There are no exposures to or potential sources of asbestos containing material (ACM) or peeling paint that could contain Lead.	Long and Short-term: **Low** **B**ased on available data
Lead Based Paint (see paragraph 10.6)	Long and Short-term: **Low** Based on available data		Long and Short-term: **Low** Based on available data
Burn Pits (see paragraph 10.7)	Short-term: **Low** During this rotation the Fire Department operated an open-air burn pit to dispose of wood pallets and also operated a burn barrel to dispose of classified paper and PII. Burning operations were conducted 0-1 times per week throughout the rotation. In accordance with AOR guidance, BE advised FD and 407 AEG leadership against any	Control measures included promoting proper waste disposal through contracted waste disposal company or incineration and promoting acquisition of cross cut shredders. Fires were kept under controlled conditions and kept small to medium in size.	Short-term: **Low** Based on available data There is a small open-air burn pit and burn barrel behind the fire department. The pit was used for burning wood pallets versus utilizing the contracted waste disposal and the barrel for classified paper until shredders are acquired. No covered waste was permitted to be burned. The burning of wood and paper as permitted

Table 2: Population-Based Health Risk Estimates – Ahmed Al Jaber Air Base and Vicinity - Kuwait [1, 2]			
Source of Identified Health Risk[3]	**Unmitigated Health Risk Estimate[4]**	**Control Measures Implemented[5]**	**Residual Health Risk Estimate[4]**
	type of open burning. BE used DoD 4715.19, AFCENT/A7/SG Burn Barrel memo, SPINS and CENTCOM CCR 200-2-1 to support this recommendation.		is not expected to produce adverse health effects.
	Long-term: **Low**		Long-term: **Low**

POEMS

Table 2: Population-Based Health Risk Estimates – Ahmed Al Jaber Air Base and Vicinity, Kuwait

Foot Example Texts:

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

[2] This assessment is based on specific environmental sampling data and reports obtained from 23 January, 2015 through 22 Jan, 2016. 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 Ahmed Al Jaber Air Base. The health risks are presented as Low, Moderate, High or Extremely High for both acute and chronic health effects. The risk level is based on an assessment of both the potential severity of the health effects that could be caused and probability that exposure would occur at a level to produce such health effects. Details can be obtained from the Army/AF/Navy/DHA Public Health Center. More detailed descriptions of OEH exposures that were evaluated are discussed in the following sections of this report.

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

[5] All OEH risk estimates represent residual risk after accounting for preventive controls in place. Occupational exposures and exposures to endemic diseases are greatly reduced by preventive measures in place. For environmental exposures related to airborne dust, there are limited preventive measures available and available measures have little efficacy in reducing exposure to ambient conditions.

SITE DESCRIPTION:

Ahmed Al Jaber Air Base, Kuwait: The country is generally low lying with the highest point being 306 meters above sea level. The topography is mostly flat. The base is located in a rural area. The installation is separated into two main areas. A living area called the "LSA" and the operational/industrial closer to the flight line. The flight line area extends from the northwest to south east portion of existing infrastructure. The main compound is on the north portion of pre-existing infrastructure. There is minimal topographical rise and fall between areas across base and extending around the perimeter. The only significant low lying area is the waste water pond known as the "green mile". It is located about 75 meters behind the main dining facility bldg. 195.

Local Climate: The spring season, beginning in March, is warm with occasional thunderstorms. Frequent winds from the northwest are cold in winter and hot in summer, while southeasterly damp winds spring up between July and October. Hot and dry south winds prevail in spring and early summer and northwesterly wind common during June and July causes dramatic sandstorms. Temperature in the summer ranges from 77 to 130 degrees Fahrenheit. Prevailing winds are from the NW at an average 9 knots. However, strong winds with dust and dirt may occur weekly. The more severe dust storms occur during the summer months. Annual rainfall varies from 10 mm (0.4 in) to 370 mm (14.6 in). Significant temperatures variations are experienced between day and night. Particularly during January which is generally the coldest month; temperatures range between 2.8 and 28.3 degrees C (27 to 85 degrees F).

1 Discussion of Health Risks at Ahmed Al Jaber Air Base, 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 US Army Public Health Command Technical Guide 230, *Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel* (USAPHC TG 230). All OEH risk estimates represent residual risk after accounting for controls measures 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 Area-Specific Sources Identified

a. At Ahmed Al Jaber Air Base, Kuwait - The general condition of the local ambient air is often dusty with a high potential for air particulate due to the lack of vegetation and soil moisture content. During high winds and dust storms, visibility may be significantly decreased. When the weather is such, potential exists for respiratory irritation and eye injury caused by wind-blown debris. The dust during these storms is so fine that piles of dust will accumulate inside of buildings and is difficult to seal out.

Particulate matter and dust debris are kicked up into the air by vehicles on both paved and unpaved roads. Even paved road become so covered with sand and dust as to result in a dust cloud forming behind a vehicle as it drives. Sand drifts also form a cross roadways deep enough to hinder driving.

Local oil fields and refineries produce constant discharges of black smoke into the air. Most of these pollutants are expected to be burned as gasses by the flares. However, frequently large black plume clouds produced from both the flares and the ground. The large black plumes have occasionally covered over base or reduced visibility. Otherwise, a black plume may cover across a significant portion of the skyline. The source and contents of these large plume clouds are not all

known. The information was not made available for this survey. Further research may be requested via the U.S. Embassy. It is known that the Kuwaiti nationals may also frequently burn trash outside of base which may further degrade air quality.

An open air burn pit and single burn barrel exists on base and is used and operated by CEF. The permit for burning is for the burn barrel only and was authorized for classified or sensitive paper documents, only.

The sewage lagoon may produce gasses from the raw sewage and does produce a strong odor which contributes to air quality.

Other factors that introduce potential ambient air hazards include: second hand smoke, vehicle and aircraft exhaust, industrial chemical fumes/gases, welding fumes, and other industrial operations as described in individual shop surveys.

b. Burgan oil field covers a large portion of land located North East of the base. Industrial operations involving several collection points and initial processing of Kuwaiti Crude Oil exists near the base. The nearest known major industrial operation is 4 km South West of Ahmed Al Jaber Air Base, Kuwait. However, onsite electric power generation by numerous tactical generators located throughout the camp base may have contributed air pollutants such as nitrogen oxide, carbon monoxide, hydrocarbons and particulate. A central power generation plant was constructed in 2015 which reduced the use of tactical generators; however, exhaust products associated with diesel fuel for electric power generation persist.

c. Open air burning was used for the destruction of wood pallets, other wood waste and for destruction of classified documents at Ahmed Al Jaber Air Base, Kuwait. Burning was not used for any other waste or refuse disposal during the period covered by this POEMS. The estimated volume of wood pallets and other waste wood disposed of in the burn pit was ranged from 0-300 pounds per week. The estimated volume of paper disposed in the burn pits ranged 0 to 1 - 55 gal barrel per day. The burning was limited to a single site behind the fire department using a 10’ X 10’ burn box and the lower half of a 55 gal metal barrel

d. Vehicle and aircraft emissions can be other major contributors to the air pollution. Emissions from military vehicles and aircrafts as well as vehicles in surrounding communities, especially in developing countries, may have significant impacts on air quality.

2.2 Particulate Matter

Particulate matter (PM) is a complex mixture of extremely small particles suspended in the air. PM includes solid particles and liquid droplets emitted directly into the air by sources such as: power plants, motor vehicles, aircraft, tactical generators, construction activities, fires, and natural windblown dust. PM can include sand, soil, metals, volatile organic compounds, allergens, and other compounds such as nitrates or sulfates that are formed by condensation or transformation of combustion exhaust. PM composition and particle size vary considerably depending on the source. Generally particulate matter of health concern is divided into two fractions: PM_{10}, which includes coarse particles with a diameter of 10 micrometers or less (0.0004 inches or one-seventh the width of a human hair), 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.

2.3 Particulate Matter, less than 10 microns (PM_{10})

2.3.1 Exposure Guidelines:

Short-term (24-hour) PM_{10} (mg/m^3):	Long-term PM_{10} MEG (mg/m^3):
Negligible MEG=0.250	Not defined.
Marginal MEG=0.420	
Critical MEG=0.600	

2.3.2 Sample data:

In 2003, ten PM_{10} samples were collected. Small amounts of Chromium, Manganese, and Nickel were sporadically detected but at concentrations well below the 1 Year Military Exposure Guidelines (MEG) criteria. This data is fourteen years old and should be re-evaluated.

2.3.3 Short-term (acute) health risk for PM_{10}: **Low**

Approach: Sampling was collected in 2003 for PM10. There were ten samples collected on AJAB for multiple locations. For a couple of the samples, Chromium, Manganese, and Nickel were detected above the sampling criteria but below the 1 year MEG criteria. This data is fourteen years old and the base dynamics have changed over time. Recommend accomplishing sampling if deemed necessary. Based on $PM_{2.5}$ sampling, sampling has shown all results to be below, to include all metals.

Risk Summary: Data is based off ten pre-screen samples and were more than fourteen years old.

Medical implications: **None**.

Confidence in the risk assessment: Confidence in the risk assessment is **low** based on the $PM_{2.5}$ air sampling data available but further sampling could be done to provide a better risk assessment on the potential hazards of the PM_{10}.

2.3.4 Long-term (chronic) health risk for PM_{10}: **Not Evaluated**

Health guidelines are not defined for PM_{10}. The United States Environmental Protection Agency has retracted its long-term standard (NAAQS) for PM_{10} due to an inability to clearly link chronic health effects with PM_{10} exposures.

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

2.4.1 Exposure Guidelines:

Short-term (24-hour) $PM_{2.5}$ MEGs (mg/m3):	Long-term (1-year) $PM_{2.5}$ MEGs (mg/m3):
Negligible MEG=0.065	Negligible MEG=0.015
Marginal MEG=0.250	Marginal MEG=0.065.
Critical MEG=0.500	

2.4.2 Sample data:

A total of 170 pre-screen ambient air $PM_{2.5}$ samples were collected from Sep 2015 - Mar 2017 at Ahmed Al Jaber Air Base for $PM_{2.5.}$ No air sampling data was available for 2013, 2014 and up to Aug 2015. All of the samples between Jan 17 - Mar 17 were invalid and then 42 other samples were invalid through the remaining samples.

2.4.3 Short-term (acute) health risk for $PM_{2.5}$: **Low**

Approach: Samples were analyzed and risk assessments were performed by the Army Public Health Center (APHC) for samples taken from 23 Sep 15 through 12 Sep 16. There were a total of 7 risk assessments performed and 5 had a Tactical Risk Estimate identified.
The peak concentrations of $PM_{2.5}$ ranged from 61 ug/m3 – 257 ug/m3. Only one peak time in the sample set (28 Oct 15 – 26 Nov 15) exceeded the Short term (24-hour) exposure and the remaining ones were below 182 ug/m3. The average samples results for these time periods were 52 ug/m3 – 77 ug/m3.

Risk Summary: Based on the samples and associated exposure information assessed from Sep 2015 – 28 Dec 2016, the tactical risk estimate for $PM_{2.5}$ on both typical and peak exposure days during the sampled timeframe is **low**. No metals were identified as acute hazards.

Medical implications: At the **low** risk level, a small percentage of individuals may experience short-term health effects such as eye, nose, throat and lung irritation, coughing, sneezing, runny nose and shortness of breath. Some individuals might seek outpatient medical care although most individuals would have experienced only mild effects which would have typically resolve when exposure ceased. A small number of individuals may experience more pronounced effects such as decreased lung function and worsening of pre-existing medical conditions such as asthma.

Confidence in the risk assessment: Confidence in the risk assessment is **high** based on the $PM_{2.5}$ air sampling data available.

2.4.4 Long-term (chronic) health risk for $PM_{2.5}$:

Approach: For chronic health risk, it was assumed that the longest deployment lasted 12 - 15 months. To assess chronic risk associated with $PM_{2.5}$, the overall yearly average concentration of $PM_{2.5}$ was used to arrive at a long term health risk for Sep 2015 – Sep 2017. The average $PM_{2.5}$ concentration during this period was determined by assessing the range of 52 ug/m3 – 77 ug/m3.

Risk Summary: Based on the samples and associated exposure information for PM2.5 on both average and peak exposure days during the sampled timeframe is **Moderate** due to the occasional exceedance of the 1 yr MEG for marginal. This risk is carried forward. No metals were identified as acute hazards.

Medical implications: Repeated exposures to airborne concentrations of $PM_{2.5}$ that carry a low to moderate long-term health risk may increase the probability for development of chronic health conditions in generally healthy troops. These conditions include reduced lung function, chronic bronchitis, chronic obstructive pulmonary disease (COPD), asthma, and certain cardiopulmonary diseases. Those with a history of asthma or pre-existing cardiopulmonary disease have a higher risk for exacerbating these chronic conditions.

Confidence in the risk assessment: Confidence in the risk assessment is **high** based on the $PM_{2.5}$ air sampling data available.

2.5 Airborne Metals

2.5.1 Sample data:

From 23 Sep 2015 - 12 Dec 2016, metals analysis was performed on 52 ambient air particulate matter samples (including PM_{10} and $PM_{2.5}$) collected at Ahmed Al Jaber Air Base, Kuwait. None of the metals screened for were detected.

Approach: For screening purposes, both peak and average concentrations of all airborne metals detected were compared to their corresponding 1-year negligible MEG. Risk estimates based on the USAPHC TG 230 methodology are calculated for any compound detected at a concentration greater than its 1-year MEG in 5% or more of the samples collected.

Risk Summary: Based on the samples and associated exposure information assessed during 23 Sep 2015 - 12 Dec 2016, no metals were identified as acute hazards.

2.5.2 Short-term (acute) health risk: **Low**.

2.5.3 Long-term (chronic) Health risk: **Low**.

Confidence in the risk assessment: Confidence in this risk assessment is **high** based on limited sampling data within this region of Kuwait.

2.6 Volatile Organic Compounds (VOC)

2.6.1 Sample data:

No VOC samples have been taken at AJAB.

Approach: Typically, most VOC sampling is either associated with a specific source or incident driven. Data of this type, especially when there is sparse sampling data exist, is generally not representative of exposure to an entire camp population.

Risk Summary: Not evaluated; no data exist upon which to base a risk assessment.

2.6.2 Short-term (acute) health risk of VOCs*:* Not evaluated; no data to base a risk assessment.

Medical Implications: All of sampled concentrations generally will not be representative of possible exposures to the entire camp population. Rather they only represent the population residing or working in proximity to the sample location. The overwhelming majority of others will have far less potential for exposure at the measured levels.

Confidence in the risk assessment: Confidence in this risk assessment is **low** based on the few samples taken and the laboratory's limited capability to quantify some VOC compounds.

2.6.3 Long-term (chronic) health risk of VOCs*:*

Approach: For screening purposes, sample results for each detected VOCs were compared with each of the corresponding Yearly (Long Term) MEG for each respective VOCs published in the USAPHC TG 230

Risk Summary: No long-term health risk was identified based on available sampling data.

Medical Implications: Not evaluated; no data exist upon which to base a risk assessment.

Confidence in risk estimate: Confidence in the risk assessment is **low** based on the lack of samples collected near Ahmed Al Jaber Air Base, Kuwait.

3 Soil

3.1 Site-Specific Sources Identified

3.1.1 Sample data*:*

In 2011, 5 groups of 49 samples were taken at random locations throughout AJAB. Results showed at DFAC, Dorm living area (260-264), Sultan Ramp and ECES compound were equal to or above the reporting limit for Barium, Chromium, Nickel and Zinc. Results showed at the Nassau Ramp was equal to or above the reporting limit for Barium, Cadmium, Chromium, Lead, Mineral Oil, Nickel, and Zinc.

Individuals involved in construction, maintenance and post-fire clean-up activities were at greatest potential for exposure to soil. These individuals comprise a relatively small proportion of the overall camp population.

Previous laboratory analysis of all soil samples included semi-volatile organic compounds (SVOCs), heavy metals, polychlorinated biphenyls (PCB), pesticides, herbicides and radionuclides. The primary exposure pathways associated with soil are dermal contact and incidental ingestion. Individuals involved in construction, maintenance and post fire clean-up activities were at greatest potential for exposure to soil. These individuals are a relatively small proportion of the overall camp population.

According to field data sheets, all previous samples were collected from areas and/or activities where there was high potential for soil exposure such as in maintenance areas, physical training (PT) areas, during excavation, while filling sand bags and/or during construction activities. Laboratory analysis of soil samples included volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), heavy metals, polychlorinated biphenyls (PCB), pesticides, fungicides, herbicides, insecticides, and radionuclides. The primary exposure pathways associated with soil are dermal contact and incidental ingestion.

Approach: Currently, sampling data for soil are not evaluated for short term (acute) health risks.

For long-term health risk, sample results were compared with each of the corresponding long-term MEGs published in the USAPHC TG 230 screening purposes. Compounds detected without a single exceedance of the 1-year MEG were excluded from further consideration. Long-term risk estimates were based on the probability of exposure to the concentrations detected.

3.1.2 Short-term (acute) health risk for soil: **Low**

Risk Summary: Personnel involved in construction and maintenance are at the greatest potential for acute exposures to soil.

Medical Implications: Not evaluated; insufficient data exist upon which to base a risk assessment.

Confidence in the Risk Assessment: Short-term health risks**: Moderate.** Personnel involved in construction and maintenance are at the greatest potential for acute exposures to soil

3.1.3 Long-term (chronic) health risk for soil: **Low**.

Risk Summary: Personnel involved in construction and maintenance are at the greatest potential for exposures to soil

Medical Implications: None

Confidence in risk estimate: Confidence in the risk assessment is **low** based on 245 samples collected across regional soils.

4 Water

In order to assess the health risk to US personnel from exposure to water in theater, the US Army Public Health Command (USAPHC) identified the most probable exposure pathways. These were based on the administrative information provided on the field data sheets submitted with the samples taken over the time period being evaluated. Bottled water is the primary source of drinking water for all deployed personnel in Kuwait. Desalinated seawater is the primary source of potable water in Kuwait. The water is filtered and treated to meet Kuwaiti Environmental Public Authority standards. The water distribution system on Ahmed Al Jaber Air Base is used for hygiene, cooking, and dishwashing. The system 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 the access and travel restrictions

4.1 Site-Specific Sources Identified

The non-potable water distribution system is supplied via two sources. The main source of water is provided by the Kuwaiti Air Base's water pump house which operates for 3 hours in the morning from approximately 0900 to noon, however, this can vary significantly. This pump house provides water to the entire Kuwait Base. The water is believed to be received onto the Kuwaiti installation from the Kuwaiti Ministry of Water via a water pipeline which feeds into the water reservoir located beside the pump house. The underground reservoir consists of 2 semi-circle tanks separated by a solid concrete centered catwalk and separated again into halves by a concrete wall; thereby creating 4 tanks total. The storage tanks are believed to hold approximately 500K gallons on each side of the catwalk. The water is not treated by the Kuwaiti Base but we disinfect the water. The water is deemed as non-potable water.

The second source is from 10K gallon water tanker trucks which pick up water from 1 of 2 alternating water source locations owned by Kuwait's Ministry of Water. They then deliver this water to the water receiving point just outside of the main gate behind the wastewater pond. The current provision has been approximately 3 trucks per day. These trucks pump the water directly onto the installation LSA via a pipeline that extends from the Hwy directly to the 4 - 100K gal storage tanks.

There is an active well on the Installation near the reservoir. There may be a second well for Kuwaiti nationals as deemed "sweet water" and the other is for "fire suppression only". The source of water into the Kuwaiti storage tanks and the status of the well(s) have not yet been confirmed. Nor has the source of the fire suppression water been confirmed. However, the Kuwaiti engineer, Engineer Ali, stated that the well provided only brackish, non-potable water, and that the water was received into the Kuwaiti tanks from the Kuwaiti Ministry of Water. Therefore, it is believed that only one well exists which only provides water to the fire suppression system.

During the Jan 17 – Jul 17 rotation a well was identified behind where the Italians are building their living quarters and to the left of the LSA entrance. Samples exceeded long term potability standards for the following analytes: Aluminum, Barium, Chloride, Iron, Lead, Manganese, Total Dissolved Solids and Turbidity. It is undetermined if this well could be a reliable source of water. A military ROWPU system would need to be employed and further analysis conducted before this water supply could be considered for consumption.

The 4 main storage tanks on the LSA are treated using batch hand chlorination with calcium hypochlorite. Fuels and Water Maintenance personnel perform this task. Due to the batch chlorination, the levels of chlorine have the potential to vary significantly from day to day depending upon temperatures, water consumption and dilution, and time from the last batch. During this rotation,

residual chlorine levels remained consistent. No positive bacterial samples have been collected within the LSA to date.

Historically, commercial bottled water was provided for drinking at Ahmed Al Jaber Air Base, Kuwait. At least 2 vendors were identified as having provided bottled water at Ahmed Al Jaber Air Base at some point during military operations in Kuwait including; Aqua Gulf and Rawdatain. Both of these brands of bottled water have been approved by U.S. Army Public Health Command. BE tests the water for bacteriological quality for every production date received.

Disinfected fresh water from onsite wells was also supplied for non-drinking purposes at Ahmed Al Jaber Air Base, Kuwait. The disinfected fresh water was used only for personal hygiene such as hand washing, showering, laundry, and cleaning.

Based on the information provided from the field, all samples for untreated water were associated with source water for treatment and no exposure pathways were associated with those samples. Therefore, untreated samples are not assessed as potential health hazards.

4.2 Consumed Water (Water for drinking or cooking consumption)

The distributors and all brands of bottled water utilized on AJAB are approved by the USAPHC. Each shipment of bottled water purchased for AJAB is tested by Bioenvironmental Engineering upon receipt IAW AFMAN 48-138. The monitoring includes total coliform presence/absence and E. coli for a minimum of 1 bottle per 10 pallets of a specific production date. The pallet count for each specific production date received is rounded up to the nearest 10 pallets for sample collection purposes.

4.2.1 Sample data/notes:

Bottled water samples, 500 ml bottles and 19 L jugs, were collected at Ahmed Al Jaber, Kuwait from January 2018 through July 2018; none of the samples tested positive for Total Coliform samples.

4.2.2 Short-term (acute) health risk for drinking bottled water:

Approach: In order to determine acute health risk associated with consumption of bottled water the following assumptions were made.

- Base residents consume 15 liters of bottled water per day or less.
- All U.S. personnel at this location were expected to remain at this site for approximately 6 months to 1 year.

Based on these assumptions, the maximum detected concentration for each analyte was compared to its respective 14-day, Negligible MEG for consumption of up to 15 liters of water per day (15L/day) and/or the short-term Field water standards published in TB MED 577, Sanitary Control and Surveillance of Field Water Supplies.

Risk Summary: Based on the above approach, the short-term risk associated with consumption of bottled water at Ahmed Al Jaber Air Base, Kuwait is low.

Medical implications: Not evaluated; insufficient data exist upon which to base a risk assessment.

Confidence in the risk assessment: Confidence in the risk assessment is **high** because US Army veterinary personnel performed quarterly audits of all bottled water suppliers to ensure consistency of quality throughout of the combat operation.

4.2.3 Long-term (chronic) health risk:

Approach: Bottled water was supplied to Ahmed Al Jaber Air Base, Kuwait in distinct lots and from approved vendors. Thus it is inappropriate to average analytical results across the spectrum of water samples/suppliers. As a result, the maximum detected concentration for each analyte was used to perform the long-term health risk screening. This process could result in overestimation of the long-term health risk as it assumes that camp residents consume water at the maximum detected concentration consistently during their deployment.

Risk Summary: **No health risk identified;** Analytical results of the bottled water samples collected revealed that no analytes were detected above their respective 1 year, 15 L/day drinking water MEG or the respective long-term pot ability standard published in TB MED 577.

Medical implications: Not evaluated; insufficient data exist upon which to base a risk assessment.

Confidence in the risk assessment: Confidence in the risk assessment is **high** for other analytes because US Army veterinary personnel performed quarterly audits of all bottled water suppliers to ensure consistency of quality throughout the deployment.

4.3 Water for Non-Drinking/Other purposes (RO and other sources of treated water)

Monitoring includes total coliform presence/absence and *E. coli*, pH and chlorine residual. Monthly M272 samples have not been sampled during this rotation because our kits are expired and have been on order during the whole rotation. Additionally, an annual comprehensive screening analysis is taken and submitted to USAPHC IAW *TB Med 577*. All Results are loaded in DOEHRS DoD Surveillance program office. While the water provided in the distribution systems meets *TB Med 577* for water potability, the systems are classified as non-potable due to lack of backflow prevention devices and the risk of infiltration to the aging system. There is also a significant risk to the location and security of the water system that is identified in the water vulnerability assessment. The system can be used for brushing teeth, washing clothes, washing dishes, and taking showers.

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

4.3.1 Sample data/notes:

From January 2017 – July 2017, treated and raw water samples were taken from multiple water source locations to determine distribution system water quality standards. Water samples were analyzed for inorganic compounds, VOC, SVOC and various physical characteristics. All samples taken at the bldg. 331 pump house (main LSA distro point) met long-term potability standards. All samples taken at the Kuwaiti cistern/access area (primary source of LSA water) met long-term potability standards. Samples taken at the Flight Line DFAC exceeded long-term potability standards for turbidity.

From Jul 2015 - Jan 2016, treated and disinfected fresh water samples were collected. Water samples were analyzed for inorganic compounds, VOC, SVOC and various physical characteristics. Preventive medicine surveillance for microbiological contaminants (coliforms/*E.coli*) is standard operating procedure, but data associated with bacteriological analyses was not available.

4.3.2 Short-term (acute) and long-term (chronic) health risks associated with water uses other than drinking:

Approach: In order to assess the health risk associated with water uses other than drinking, the following assumptions were made:

- Treated water was used for personal hygiene purposes.
- Deployments lasted is service specific (Army personnel 9 months, AF personnel 6 months and Navy and Marine personnel from 12 to 15 months or less if personnel were forward deployed).
- Primary routes of exposure associated with treated water were incidental ingestion through personal hygiene (i.e., brushing teeth/oral hygiene) and dermal contact when showering.
- Camp residents ingest far less than 15 liters (food preparation) of RO treated water per day.
- Disinfected fresh water was used only for showering and hand washing.

Based on guidance provided in USAPHC Technical Guide 230, *Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel* (USAPHC TG 230), any compound with a peak concentration less than or equal to 2.5 times the 14-day negligible MEG for consuming 5 liters of water per day/ (5-L/day) may be eliminated from further consideration. If a 14 day, 5-L/day negligible MEG was not available, the more conservative 1-year, 5-L/day negligible was used for screening purposes.

4.3.2.1 **RO Treated Water (used for cooking and personal hygiene).**

4.3.2.2 Sample data/notes:

Reverse Osmosis (RO) unit at Green Beans is piped to all restaurants at the AAFES food court (Green Beans, Taco Bell, Subway, and Pizza Hut). Distribution system water is treated at point of use. Ultraviolet Radiation

UV Water Treatment Distribution system water is treated at point of use by a 3-stage filter with UV sterilizer. Water is filtered by a sediment filter, then filtered by two high capacity charcoal filters prior to passing through a UV sterilizer for final disinfection. 6Pazzi

In May 2018, treated and raw water samples were taken from multiple water source locations to determine distribution system water quality standards. Water samples were analyzed for inorganic compounds, VOC, SVOC and various physical characteristics. All samples taken at the bldg. 331 pump house (main LSA distro point) met long-term potability standards. All samples taken at the Kuwaiti cistern/access area (primary source of LSA water) met long-term potability standards. Samples taken at the Flight Line DFAC exceeded long-term potability standards for turbidity.

Risk Summary: No acute or chronic health risks associated with incidental ingestion of RO treated water were identified. **Low** Risk

Medical Implications: None identified.

Confidence in the Risk Assessment: Confidence in the risk assessment is **high**. Complete chemical analysis of 10 reverse osmosis water samples taken in 3 years (by counting number of years of available data) is far more sampling data than one would expect to see from drinking water sources in the United States. There was also an active and ongoing drinking water surveillance program at Ahmed Al Jaber Air Base, Kuwait which further increases confidence in this assessment.

4.3.2.1 **Disinfected Fresh Water (used for personal hygiene)**.

Evaluation of the samples of treated fresh water did not reveal any exceedances of USAPHC TG 230 health risk screening criteria.

Risk Summary: **Low** acute or chronic health risks associated with incidental ingestion of disinfected fresh water during showering were identified at Ahmed Al Jaber Air Base, Kuwait.

Medical Implications: None identified.

Confidence in the Assessment: Even though there are relatively few samples in the data set, confidence in this risk assessment is **high** based on the limited potential for ingestion of host nation treated water.

5 Military Unique

5.1 Chemical Biological, Radiological Nuclear (CBRN) Weapons

There were no specific hazard sources or exposure incidents documented in the Defense Occupational and Environmental Health Readiness System (DOEHRS) or the Military Exposure Surveillance Library (MESL) during the period from May 2004 - July 2018.

5.1.1 Short and long-term health risks: **Low**

Risk Summary: **Low** - During previous rotations, M272 kits were run monthly on distribution system water. M272 sampling is now conducted randomly and when threat and force protection conditions warrant increased sampling for CBRN. Emergency Management flight runs a DFU for 24 hours and runs an HHA during each rotation. No samples to date have shown any indication of CBRN.

Medical Implications: **None** - insufficient data exists upon which to base a risk assessment.

Confidence in the Risk Assessment: **High** – Based on the CBRN intelligence, Kuwait has a low threat and with the continued, random sampling there has been no indication of CBRN use upon which we can base a risk assessment confidence as high.

5.2 Depleted Uranium (DU)

Depleted Uranium (DU) has been stored at Ahmed Al Jaber Air Base, Kuwait from Nov 2014 - July 2018. There were no exposure incidents documented in the Defense Occupational and Environmental Health Readiness System (DOEHRS) or the MESL during the period from Nov 2014 - Jul 2018 time frame. The DU was stored in the form of 30 mm rounds contained within sealed and marked metal ammo storage cans at the munitions storage site. Radiation surveys were conducted on 30 December 2014, 17 February 2015, 28 February 2017, and 20 December 2017 and are documented in DOEHRS. The DU was stored under permit provided by the radioisotope committee (RIC) during this time frame. The DU rounds were stored in a munitions controlled site with a guarded gate. The majority of base personnel were not authorized to enter the area. The DU was not moved from its single storage pad during the period from Nov 2014 - Mar 2016. In Apr 2016, the DU was moved to a new revetment pad within the same munitions storage area. Both storage pads consist of an asphalt pad surrounded by dirt berms along three sides with the fourth side facing a road. The final revetment location has a sun shade built to shelter the DU rounds. Background readings were measured across the street from the sources. **Personnel are not expected to enter the revetment pad except for monthly to conduct inventory or load trailer for 1 hour or less.**

In addition, there is a large red, locked conex on the left side of the road that leads out to the Munitions Storage Area, containing DU. This conex belongs to the Kuwaiti host nation, and contains DU fragments in the form of two plastic 55 gallon drums and a few miscellaneous boxes. EOD conducted an operation to remove the DU projectiles. The DU capsules and soil are stored inside a plastic tri-wall inside the conex. The conex is currently labeled.

5.2.1 Short and long-term health risks:

The highest exposure rate inside the revetment was measured to be 1.98 mR per hour. Based on worst-case scenario calculations, the projected annual radiation dose for an individual inside the revetment will only be above the general public dose limit (100 mrem per year) if someone stands within 1 foot of the containers for over 50 hrs per year. Personnel enter the area on a routine basis to conduct inventories or load trailers and this work usually lasts less than one hour per day. Based on this, workers would not exceed the annual occupational exposure dose limit (5000 mrem per year).

Risk Summary: **Low**. Based on workload, **personnel will not be exposed to radiation levels above the occupational exposure dose limits.**

Medical Implications: The highest exposure rate measured was 1.98 mR/hr at one inch from the container. Therefore, the highest dose someone can receive in any given hour would be 2.0 mrem. This reading is just below the federal occupational limit of 2 mrem in any given hour for a member of the general public. General public dose limits: 2 mrem in any given hour, 100 mrem in a year (10 CFR 20.1301).

Confidence in the Risk Assessment: Confidence in this risk is **High.**

5.3 Ionizing Radiation

5.3.1 Industrial Radiography

We have 5 x-ray units on base. Explosive Ordnance Disposal (EOD) has one and takes x-rays of suspicious packages/munitions. Security forces personnel use 3 at the vehicle search area: Rapiscan (OCN personnel scanner), large vehicle x-ray unit (at the entry into the VSA) and a mobile van x-ray unit. Only the RAPISCAN was functioning during this rotation. The final one belongs to the EMEDS and is for medical x-rays. The radiography technician during this rotation is a Navy Corpsman and was enrolled in the thermoluminescent dosimetry (TLD) program. The program was implemented in Jul 2015 and continues through this rotation.

5.3.2 Radioactive Material

There are no permitted radioactive materials or generally licensed devices except the DU listed above. All ionizing sources are limited to check sources for BE, EOD, or CEX equipment.

5.3.3 Short and long-term health risks:

TLDs were received for studies Jul 2015 and no TLD studies were completed from Nov 2014 - Jul 2015. Any TLD studies conducted prior to Nov 2014 are obsolete.

Risk Summary: The risk is **low** based upon radiation scatter surveys documented in the Defense Occupational and Environmental Health Readiness System (DOEHRS) and administrative procedures in place to maintain exposures As Low As Reasonable Achievable (ALARA).

Medical Implications: None.

Confidence in the Risk Assessment: Confidence in this risk is **High**.

5.4 Non-Ionizing Radiation

There are approximately 700+ AF EMF sources on AJAB. Most are low risk and four are moderate to high. Surveys are identified and completed in DOEHRS under the Expeditionary Communications Squadron Network Maintenance.

The Lasers identified on AJAB are primarily located in the Expeditionary Civil Engineering Squadron with a rating of 3B or above. The laser inventory is an ongoing process and was just started in the January – July 2017 rotation. We

5.4.1 Short and long-term health risks:

Risk Summary: The risk is **low** due to procedures that are in place to maintain exposures below the permissible exposure limits.

Medical Implications: None

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

6 Endemic Diseases

6.1 Sample data/notes:

The assessed risk for endemic diseases addressed below represents the residual risk that exists in the presence of preventive measures.

Department of Defense Directive 6490.02 series, Comprehensive Health Surveillance, establishes policy for routine health surveillance of all DoD personnel throughout their military service. The Armed Forces Health Surveillance Branch (AFHSB) maintains archives of medical event reports for all Services.

Medical event reports identified related to deployment in Kuwait did not identify specific locations within the country, nor did they describe the probable site of the exposure; therefore, epidemiological analysis of medical event data was limited to the country level.

Endemic diseases present in Kuwait were assessed by referring to the Defense Intelligence Agency's Infectious Disease Risk Assessment Database for CENTCOM: Kuwait at https://www.ncmi.detrick.army.mil/product/idra_db.php?co=KWT and the "Destinations" section of the Centers for Disease Control and Prevention (CDC) Travelers' Health website, http://wwwnc.cdc.gov/travel/destinations/traveler/none/kuwait.

Where effective vaccines, such as those for Hepatitis A and B, are in place, risk to individuals is effectively reduced to none and these endemic diseases were excluded from further assessment. Reporting of medical events from deployed environments is inconsistent. Identified reports of endemic disease associated with deployment to Kuwait are assumed not to represent all cases of reportable endemic disease events among service personnel deployed to Kuwait. Where available; additional relevant reports were used to supplement reportable medical event data for this assessment.

6.2 Gastrointestinal Diseases

U.S. Service members have little or no immunity to the food and waterborne diseases present in Kuwait. To prevent food and waterborne diseases among individuals deployed to Kuwait, food and water are purchased from approved sources. Food is prepared in facilities where there is public health

oversight (certificate of sanitation, health screening of food service workers, periodic inspections, etc.). Due to the potential presence of disease causing organisms, as well as the high prevalence of improper food handling and preparation, local food and water were not approved for consumption. Viral gastroenteritis that is spread through contact or fomites (any inanimate object or substance capable of carrying infectious organisms) presents a recurrent risk due to a high rate of personnel turnover, and shared dining, bathroom facilities, and working spaces.

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

6.2.1 Short -term health risks*:*

Risk assessment: The short-term risk for viral gastroenteritis was **moderate.** Risk due to a high rate of personnel turnover, shared dining, and bathroom facilities, and working spaces is not substantially different than that expected in similar settings within the United States.

The short-term risk associated with food borne and waterborne diseases in Kuwait was **high** (bacterial or viral gastroenteritis

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

Confidence in the risk assessment: Confidence in the risk assessment is **medium**. Food and water borne diseases, especially those with short convalescence and lack of long-term health effects are often underreported for deployed military populations.

6.2.2 Long-term (chronic) health risks:

Risk assessment: The long-term risk associated with food diseases were **low**

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

Confidence in the risk assessment: Confidence in the risk assessment was **high.** Incidence of protozoal diarrhea and brucellosis in the post deployment military population is known to be extremely low.

6.3 Arthropod Vector-Borne Diseases

The climate and ecological habitat found in Kuwait support populations of arthropod vectors, including mosquitoes, ticks, and sand flies. Risk for arthropod-borne disease is higher during warmer months (typically from Apr - Nov); with variable rates of disease transmission (vector-borne diseases occur at low or unknown levels throughout the country). Personnel may have been exposed to mosquitoes, ticks, sand flies, or other biting vectors both during the day or night. Risk is higher in urban and other densely populated areas, or near where animals were kept. Removing vector harborages, spraying for vectors within base camps, avoiding animals or areas where they were kept, proper wearing of insecticide-treated (permethrin) uniforms, use of bed nets in field conditions, and the application of insect repellent to the skin (DEET) were the main protective measures against vector-borne diseases.

Approach: The health risk for endemic vector-borne diseases to individuals deployed to Kuwait during the period of this assessment was epidemiologically assessed based on the combination of identified endemic diseases, knowledge of preventive measures in place, review of medical event reports associated with deployment, and review of military public health reports.

6.3.1 Short-term (acute) health risks:

Risk assessment: The short-term risk for the vector-borne diseases visceral leishmaniasis, sandfly fever, West Nile Fever, Crimean-Congo hemorrhagic fever, typhus, and plague was **low**. Individuals who deploy from Ahmed Al Jaber Air Base, Kuwait or rural outlying areas may experience increased short-term risk.

The short-term risk for cutaneous leishmaniosis was **moderate**.

Medical implications:

Malaria, sandfly fever, West Nile Fever, Crimean-Congo hemorrhagic fever, typhus, and plague present in Kuwait have fairly short incubation periods ranging from days to weeks. Any of these diseases would initially present as acute fever and malaise, some accompanied by rash, and would lead to acute, sometimes severe illness.

Cutaneous leishmaniosis typically presents as skin lesions, single or multiple, that start as a papule and enlarge into an ulcer.

Confidence in the risk assessment: Confidence in the risk assessment is **moderate**. Reports of vector borne disease, West Nile Fever positive, were received through official DoD medical event reporting systems through USAFSAM Entomology Department June 22, 2016.

6.3.2 Long-term (chronic) health risks:

Risk assessment: The long-term risk for leishmaniosis, cutaneous and visceral, was **low**. The long-term risk for *vivax* (relapsing) malaria was **low**.

Medical implications:

Both visceral and cutaneous leishmaniosis may have extended incubation periods, ranging from a months to years. Although rare, it is possible to be infected during deployment, but not to have clinically evident disease until redeployed. Leishmaniosis should be considered in the differential diagnosis for any unusual skin lesions, or chronic, systemic disease. According to the U.S. AFCENT Pre-Deployment Medical Screening Procedures of 14 April 2017, malaria was not a concern in Kuwait. If any, Plasmodium v*ivax* and P. *falciparum* malaria would be the predominate species of malaria found in Kuwait. Relapses following *vivax* blood stage treatment are possible due to hypnozoites that remain dormant in the liver.

Confidence in the risk assessment: Confidence in risk assessment is **moderate**. Incidence of visceral leishmaniosis in the post deployment military population is known to be low. Cases of cutaneous leishmaniosis were detected and treated post deployment. The military medical community was/is aware of the presence of leishmaniosis in Kuwait, and skin lesions in individuals with a history of time spent in Kuwait were/are evaluated with that in mind. No cases of relapsing malaria have been reported in the Service-mandated reporting systems.

6.4 Water Contact Diseases

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

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

6.4.1 Short-term (acute) health risks:

Risk assessment: The short-term risk is **low.**

Medical implications: **None**

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

6.4.2 Long-term (chronic) health risks:

No long-term health risk was identified.

6.5 Respiratory Diseases

U.S. military populations living and working in close-quarter conditions were at risk for substantial person-to-person spread of respiratory virus infections such as the common cold and influenza. Primary exposure pathways for tuberculosis include prolonged close contact (generally several hours per day for greater than three days per week in a closed space) with the local population or third country national contractors. U.S. personnel who remained on base had limited to no contact with the local population, and local and third country national workers/contractors were required to complete health screening prior to employment.

Approach: The health risk for respiratory diseases to individuals deployed to Kuwait during the period of this assessment was epidemiologically assessed based on the combination of identified endemic diseases, knowledge of preventive measures in place, review of medical event reports associated with deployment to Kuwait, and review of military public health reports.

6.5.1 Short-term (acute) health risks:

Risk assessment: The short-term risk for upper respiratory infections was **low.** Risk due to a high rate of personnel turnover, shared dining, berthing, recreational facilities, and working spaces is not substantially different than that expected in similar settings within the United States.

The short-term risk for tuberculosis was **low per NCMI**.

Medical implications: Upper respiratory infections, particularly from viral agents, can cause periodic outbreaks in spite of preventive measures. A small proportion of infections may require greater than 72 hours convalescence and/or hospitalization. Symptoms of tuberculosis, including fever, weight loss, night sweats and cough, typically start within 1-6 months of infection. The lifetime risk for tuberculosis after becoming infected is 5-10%; half of this risk occurs in the first two years following infection.

Confidence in the risk assessment: Confidence in risk assessment is **medium**. Upper respiratory infections, especially those with short convalescence and lack of long-term health effects are not reportable for deployed military populations. Tuberculosis prevalence in the local population is widespread, but no reports of tuberculosis were identified for individuals deployed to Kuwait during the assessment period.

6.5.2 Long-term (chronic) health risks:

Risk assessment: The long-term risk for tuberculosis was **low**.

Medical implications: Symptoms of tuberculosis can be delayed by two or more years following infection. Tuberculosis should be considered in assessing symptoms of fever accompanied by night sweats and cough.

Confidence in the risk assessment: Confidence in risk assessment is **high**. Prevalence of tuberculosis in the local population is widespread, but prevalence of tuberculosis in the post deployment military population is known to be extremely low.

6.6 Animal-Contact Diseases

Animals in Kuwait were not routinely vaccinated against vaccine preventable diseases such as rabies or anthrax. Q-fever, anthrax, and rabies are known to be present in Kuwait. Exposure to animals, and/or locations where animals were kept (stray dogs/cats, barnyards, slaughterhouses), were the primary infection sources for all these diseases, and avoidance of companion and farm animal contacts was the primary prevention strategy. Preventive measures in place include anthrax vaccination, which is effective in preventing both cutaneous and inhalation anthrax, and rabies post exposure prophylaxis, which is effective for preventing onset of rabies in exposed individuals.

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

6.6.1 Short-term (acute) health risks:

Risk assessment: The short-term risk for Q-fever was **moderate.** The short term risk for rabies and anthrax are rated as **low**.

Medical implications: Naturally occurring anthrax (non-weaponized) is an acute disease that usually affects the skin, while inhalation anthrax has mild and non-specific initial symptoms among unimmunized individuals.

Symptoms of acute Q-fever, which may present one week to greater than one month after exposure, include fever, chills and weakness.

Rabies presents as an acute, viral encephalomyelitis and is almost invariably fatal.

Confidence in the risk assessment: Confidence in risk assessment is **high**.

6.6.2 Long-term (chronic) health risks:

Risk assessment: The long-term risk for Q-fever and rabies was **low**. However, Q-fever was diagnosed in a small number of personnel after they returned to the U.S.

Medical implications: Q-fever is generally an acute febrile disease. However, considerable variation in severity and duration may be seen; infections may be unapparent or present as a nonspecific undifferentiated febrile syndrome or as pneumonia. Q-fever should be considered in the differential diagnosis of an undifferentiated febrile syndrome when personnel mention a history of being near or in areas where animals were kept or had been kept.

The incubation period for rabies is typically 1–3 months, but may be more than one year.

Confidence in the risk assessment: Confidence in risk assessment is **high**.

7 Venomous Animals/Insects

The species listed below have home ranges that overlap the country of Kuwait, and may present a health risk if encountered. Information was taken from US Army Public Health Command, Armed Forces Pest Management Board Living Hazards Database, and personal communication from previously deployed preventive medicine personnel. Little to no regional (within the country of Kuwait) animal range information was available. The below list should not be considered all inclusive; other venomous scorpions and snakes may be present in the region. See Section 10 for more information about pesticides and pest control measures.

7.1 Short-term (acute) health risk:

7.1.1 Spiders: Numerous species of spiders are found in Kuwait. The Black Widow Spider (*Latrodectus lugubris*), camel spiders (*Solifugae*), Trantula, and Yellow Sac Spider are known species whose bite presents a threat. Widow spider bites are mostly minor and even significant envenomation is unlikely to be lethal. Bite is usually felt as a "sting", with delayed (10+min) local pain and sweating. More severe envenomation may produce regional pain, tender draining lymph nodes, nausea, hypertension, and malaise. Camel spider bites are very painful and may cause a localized reaction but an all over reaction is rare. Brown recluse spider bites often go unnoticed initially because they are usually painless bites. Occasionally, some minor burning that feels like a bee is noticed at the time of the bite. Symptoms usually develop 2-8 hours after a bite. Keep in mind that most bites cause little tissue destruction. Initially the bite site is mildly red and upon close inspection may reveal fang marks. Within a few hours, the redness gives way to pallor with a red ring surrounding the area, or a "bull's-eye" appearance. The lesion will often appear to flow downhill over the course of many hours. The center area will then often blister, which over 12-48 hours can sink, turning bluish then black as this area of tissue dies. Health risk was **low**.

7.1.2 Scorpions: Numerous species of scorpion are found in Kuwait. The majority of scorpions found in the region have stings that cause only short lived local effects, such as pain, without systemic effects. Serious envenomations may result in numbness, frothing at mouth, difficulty breathing, and convulsions. Various factors influence the severity of the envenomation to include health and age of patient, sting site, and size and age of scorpion. Most scorpion venom is neurotoxic with a mixture of other substances. If the patient is allergic to bee and wasp stings, extreme caution and care must be taken to prevent excessive morbidity and even possibly death. The following three scorpions are listed as present in Kuwait and have known detrimental health effects:

- *Androctonus amoreuxi* (Fat-tailed scorpion).
- *Androctonus crassicauda (Arabian fat-tailed scorpion)*
- *Leiurus quinquestriatus (Death Stalker)*
- *Hemiscorpius lepturus* (highly cytotoxic venom which can cause serious wounds, inflammation, blisters, and necrosis. No antivenom is currently available).
- *Hottentotta alticola* (Black scorpion)*, Hottentotta saulcyi, Hottentotta scaber,Hottentotta schach, Mesobuthus eupeus, and Odontobuthus doriae*

Overall health risk from scorpions was **low**.

7.1.3 Snakes: Numerous species of snakes are found in Kuwait. A number of poisonous snakes, whose range incorporates Kuwait, could have been encountered to include cobras, pit vipers, and vipers. The following list of vipers and cobras in the area, but rather those deemed most significant or potentially encountered.

- *Macrovipera lebetina* (Levantine Viper): Bites may cause mild to severe local effects, including shock and coagulopathy.
- *Cerastes cerastes gasperetti* (Desert Horned Viper): Cause the majority of the bites. Envenomation causes deep local tissue damage accompanied by stomach pain, sweating, nausea, possible fever in conjunction with gangrene
- *Echis carinatus* (Saw-scaled Viper): Bites are typically moderate to severe, with potentially lethal envenoming, requiring urgent assessment and treatment, including IV fluids, IV antivenom and good wound care. Antivenom is key for the treatment of systemic envenoming.
- *Pseudocerastes persicus fieldi (Field's Sand* Viper): venom characterized as neurotoxic; little pain at bite site general weakness followed by paralysis
- *Pseudocerastes persicus persicus* (Persian Sand Viper): venom characterized as hemorrhagic; immediate and severe pain at bite site
- *Walterinnesia aegyptia* (Desert Black Snake/Desert Cobra): venom strongly neurotoxic with lesser anticoagulant activity.

Overall, the health risk associated with snakes was **low**. Snake sightings and reports of snakes within the living areas were an occasional occurrence. Peak incidence occurs in June through August.

7.2 Long-term (chronic) health risk:

No long-term health risks were identified based on available data.

Risk assessment: The long-term risk associated with snakes was low based on disease incident reporting from Kuwait.

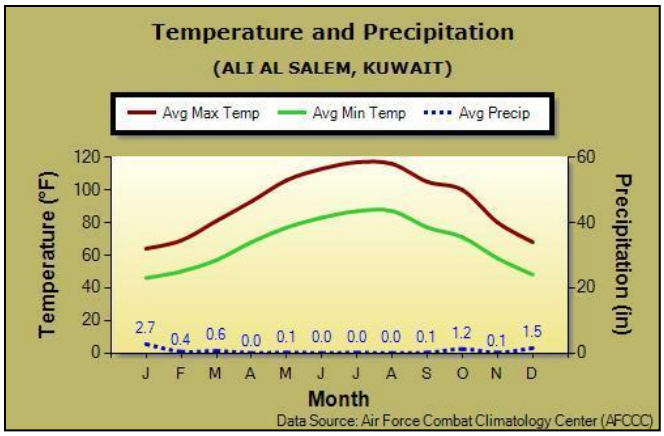
Medical implications: Long-term health effects resulting from interaction with snakes is **low** based on efficacy of control measure as evidenced by lack of disease(s) reported in various medical surveillance data bases e.g, TMDS, MERS, DRSi as per incident reporting from Kuwait.

Confidence in the risk assessment: Confidence in risk assessment is **high** based on disease incident reporting from Kuwait.

8 Heat/Cold Stress

8.1 Site-Specific Conditions

Kuwait's climate is subtropical desert climate with two distinct seasons. Summer is May - Oct, and winter is Nov - Apr. During the summer months frequent sand storms are caused by arid shamal winds which blow across the Persian Gulf. Average daily wind speed is 9.4 mph. Winter brings all of Kuwait's annual precipitation (0.2-1 inch), which is sometimes heavy enough to produce minor local flooding.



8.2 Heat

8.2.1 Heat Exposure Guidelines

The risk of heat injury is based on the Wet Bulb Globe Temperature Index as follows:

- **Low** (80-84.9 °F)
- **Moderate** (85-87.9°F)
- **High** (88-89.9°F)
- **Extremely High** (≥ 90°F)

8.2.2 Short (acute) and long-term (chronic) health risk:

Approach: No heat casualty, medical event reports involving heat injuries or heat stress monitoring data were available in the Defense Occupational and Environmental Health Readiness System or the Military Exposure Surveillance Library for any of the camps covered in this assessment. Accordingly, risk estimates are based strictly on existing climatologic data.

Risk Summary:

Short-term (acute) health risk: **Variable**, **High** health risk of heat injury for un-acclimatized personnel from Apr - Oct, and **Low** from Nov - Mar. The risk of heat injury was reduced through preventive measures. Because the occurrence of heat stress/injury is strongly dependent on operational factors (work intensity and clothing), confidence in the health risk estimate was low (TG 230, Table 3-6).

Long-term health risk: **Low,** long-term health implications from heat injuries are rare but can occur, especially from more serious injuries such as heat stroke. However, the health 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.

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

Confidence in the risk assessment: Based on generally available information on climatic conditions and the absence of reported heat injuries, confidence in risk assessment is **medium.** Individuals who experienced mild symptoms of heat injury may not have sought medical attention; this may lead to an underestimation of the risk.

8.3 Cold

8.3.1 Short (acute) and long-term (chronic) health risks*:*

Approach: No cold injury data were available in the DOEHRS or MESL for any of the camps covered in this assessment. Accordingly, risk estimates are based strictly on existing climatologic data.

Risk Summary: The risk for cold stress/injuries is largely dependent on clothing/equipment worn, operational work intensity and individual factors rather than environmental factors alone. The acute and chronic risk for non-freezing cold injuries, such as chilblain, trench foot, and hypothermia was **low.**

Medical implications: The cooling of body parts may result in various cold injuries - nonfreezing injuries, freezing injuries and hypothermia which is the most serious. Toes, fingers, ears and nose are at greatest risk because these areas do not have major muscles to produce heat. In addition, the body will preserve heat by favoring the internal organs and thus reducing the flow of blood to the extremities under cold conditions. The most severe cold injury is hypothermia which occurs from excessive loss of body heat and the consequent lowering of the body's core temperature.

Confidence in the risk assessment: Based on generally available information on climatic conditions and the absence of reported cold injuries, confidence in risk assessment is **high**. Individuals who experienced mild symptoms of cold injury may not have sought medical attention; this may lead to an underestimation of the risk.

9 Noise

9.1 Continuous

9.1.1 Exposure Guidelines:

The Services have established occupational exposure limits (OEL) for continuous or intermittent noise at 85 decibels on the A-weighted scale (dB(A)), 84 dB(A) for the Navy, as an eight hour time-weighted average (TWA). The A-weighted scale of noise measurement is used because it mimics the human ear's response to sound. All Services require that individuals routinely exposed to noise levels greater than the OEL be enrolled in the hearing conservation program. Generally, routinely exposed is defined as when the TWA exceeds 85 dB(A) on average more than 2 days in any month.

9.1.2 Site Specific Conditions:

Sources of potential noise include flight line operations, associated with both fixed and rotary wing aircraft, tactical generators and various hand tools in maintenance shops. Due to the inherent noise hazard in flight line operations, personnel were required to wear dual hearing protection.

9.1.3 Short (acute) and long-term (chronic) health risk:

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

Risk Summary:

Short-term health risk: The short-term risk of noise induced hearing loss is **moderate**. Use of hearing protection will reduce the risk to low. A few exposed individuals are expected to have experienced

noticeable short-term health effects such as annoyance, speech interference, fatigue and temporary hearing threshold shifts during deployment.

Long-term health risk: The long-term risk of noise induced hearing loss is **moderate**. Use of hearing protection will reduce the risk to low.

Confidence in the Risk Assessment: Confidence in the health risk assessment is **moderate**. There is a well-established hearing conservation program; hearing protection is readily available and generally worn by individuals with known occupational exposures across the Services. However, the limited availability of information about specific noise sources and enforcement of the use of personal protective equipment diminishes confidence.

9.2 Impulse

No information about potential sources of impulse noise (140 dbA) or greater) have been identified.

9.2.1 Short-term (acute) and Long-term (chronic) health risks:

Low: Noise source survey data have shown no sources of impulse noise hazards.

10 Unique Concerns

10.1 Special Incidents or Spills:

10.1.1 Site Specific Conditions:

There are two dirt mounds along munitions road, one on each side of the road. The mounds are known to have the potential for containing UXOs left over from the Gulf War in the 1990s era. The areas were appropriately marked with UXO warning signage. Numerous UXOs have been discovered across the installation, particularly outside of the LSA area from Nov 2014 - Jan 2016. EOD has disarmed many of these UXOs but warns that there may still be many more. Personnel should not stray off the paved road when outside of the LSA. Sometime between Feb - Apr 2015, EOD responded within a few miles outside of the installation after a local camel herder who had reportedly been handling a UXO when it detonated and killed him. Also, EOD found a location that still contained DU Projectiles that were still in the ground. They removed them and added them to the rest of the items on munitions road.

Medical implications: None

Risk Summary: High personnel are briefed during their Warbirds in processing briefing that there is a high potential of finding UXOs, especially when there is any digging. Not all areas have been cleared and UXOs are still being found. Follow proper procedures of cordoning off location and contacting EOD if any UXOs are found or suspicion of a UXO.

Confidence in the Risk Assessment: **Moderate** based upon information personnel are trained on the procedures to follow if there is a UXO found/identified. EOD personnel are trained and have proper equipment to disassemble and handle UXOs.

10.1.2 Site Specific Conditions:

Nov 2014: 80 gal of JP-8 leaked on the flight line. Fire Department was able to contain spill area and clean up.

On 12 May 2015 a marine unit spilled a 55 gal drum of 15W-40. The spill was contained across the loose surface sand while the hard packed layer approximately 6 inches below the surface sand was unaffected. The area of contaminated sand was shoveled into palletized box crates and removed for disposal. CE maintained oversight of the cleanup and then PAE provided removal and oversight of the palletized dirt-filled crates.

On 14 March 2017 a marine unit spilled approximately 200 gallons in the Marine fuel storage area due to a fault O-ring on the hose. The soil was cleaned up and contracted to be removed off base.

On 5 Mar 2018, a diesel tank cracked and spilled 27K gallons into the berm it was located in. The diesel fuel was pumped out and most was recovered but the remainder was taken for disposal. The fuel was contained in the berm.

It is uncertain if any spills or fire incidents may have occurred that have health risks as a result of the Iraqi invasion and occupation of Kuwait during the first Gulf War.

Medical implications: None

Risk Summary: **Low:** Based on available this is on a case by case basis and depends significantly on the type of operations that are occurring at AJAB. If a spill occurs, the site is remediated to dispose of the potential hazard.

Confidence in the Risk Assessment: Based on available information on spill plan response procedures, notification procedures and personal protective equipment worn, confidence in risk assessment is **high**.

10.2 Waste Sites/Waste Disposal

Approach: Knowledge of the U.S. Central Command and Service specific policies and procedures served as the basis of this risk assessment.

10.2.1 Site specific sources identified:

Four sources of waste exist on base, medical, non-hazardous solid waste, hazardous industrial waste, and sanitary sewer/latrine waste. Base personnel have minimal contact with this waste and risk to any exposure is high. Hazardous medical waste (red-bagged or sharps containers) generated by the medical group is staged in an outdoor locked Connex that is controlled by medical staff. The medical waste is delivered by medical technicians as needed to camp Arifjan for incineration. During transportation the medical waste is double bagged sealed within boxed crates. Non-hazardous solid waste generated by base residents is disposed of in various trash bins throughout the base. The trash bins are emptied through a host nation contractor. Currently, proper handling, storage, and disposal of industrial waste generated on base are coordinated at the unit level. Waste is turned in to the central short term storage hazardous material/waste satellite storage site which is managed by the base environmental coordinator (PAE contract personnel: Alando Ownes). The waste is removed by host nation contract personnel.

The sanitary sewer is a plumbed system from all hard structured buildings within the LSA. The sewage is pumped via 3 of 5 lift stations into the untreated raw sewage pond about 70 meters behind the dining facility. Numerous incidents have occurred where the lift station pump failed and the sewage over flowed onto the ground or across the road and personnel walked through the flooded areas. CE utilities personnel frequently work on the sewer lines, system, or may enter confined spaces where the sewer flows in order to conduct maintenance.

Portable latrines and shower/shave bladders are pumped out by contract personnel operating service tanker trucks and waste is disposed of off base by the same contract personnel.

10.2.2 Short-term (acute) and Long-term (chronic) health risks:

Risk Summary: Short and long-term risk is **Low** based on available data**.**

Medical Implications: None

Confidence in the risk assessment: Confidence in the risk assessment is **Low**.

10.3 Potential Environmental Contamination Sources

In addition to environmental exposures already discussed, there may be specific occupational exposure pathways associated with aircraft, vehicle and site maintenance. Typical chemicals of concern associated with potential occupational exposures were petroleum, oils, and lubricants. No industrial hygiene data exist to document the significance of occupational exposures; however, there were typically procedures in place for storage, handling, use and disposal of hazardous materials which generally minimize health risk.

Approach: Knowledge of the U.S. Central Command and Service specific policies and procedures served as the basis of this risk assessment.

10.3.1 Short-term (acute) and Long-term (chronic) health risks: **Not Evaluated** - No data was available upon which to base a risk assessment.

Risk Summary: None based on lack of available data upon which to base a risk assessment.

Medical Implications: None - No data were available upon which to base a risk assessment.

Confidence in the risk assessment: Confidence in the risk assessment is **low**. Typical chemicals of concern associated with potential occupational exposures are petroleum, oils, and lubricants. These were generally present in relatively low volumes. Procedures for storage, handling, use and disposal of hazardous materials were in place throughout the theater of operations to minimize health risk.

10.4 Pesticides/Pest Control:

Both contract and military vector control personnel mitigated pests and vectors in accordance with mandated integrated pest management practices. The overwhelming majority of efforts at Ahmed Al Jaber Air Base, Kuwait were in the reduction of filth flies, rodents, and feral animals (cats). Non-chemical measures such as exclusion measures and sanitation were first and primary efforts. Secondary measures included the use of targeted bait applications for flies and mosquitos and rodents, and various animal trapping methods. Tertiary measures included the application of pesticides which contained active ingredients that degraded rapidly in the Kuwait environment. On-site or regional oversight was provided as available to ensure compliance with Theater, Navy, and DoD practices and regulations.

10.4.1 Short and Long-term (chronic) health risk

Approach: The Integrated Pest Management Plan for Kuwait was reviewed for compliance with DoDI 4150.07 requirements. In addition, U. S. military entomologists who served at Ahmed Al Jaber Air Base, Kuwait and the Navy Entomology Center of Excellence were consulted about their knowledge of pest management activities at these camps.

Risk Summary: Low based on available data.

Confidence in the risk assessment: Confidence in the risk assessment is **moderate**. We know what pesticides are sprayed and they are sprayed on the sewage pond and in the lift stations to keep down the mosquito population. Spraying is performed in the early morning hours and the wind direction pushes the pesticides directly off base.

10.5 Asbestos and Lead-Based Paint

10.5.1 Site-Specific Conditions:

All structures occupied by U.S. personnel during the period were erected as new. Therefore, there was no exposure to potential sources of asbestos containing material (ACM) or peeling paint that could contain lead. In 2016, It was definitively determined that the swimming pool wall is painted with lead. The lead check indicator was positive for lead. Mitigation was conducted by encapsulating the paint with non-lead based paint.

10.5.2 Short-term (acute) health risk:

Risk Summary: Short-term risk is **low** based on available data.

Medical Implications: None**.**

Confidence in the Risk Assessment: Confidence in assessment is **high** based on available data**.**

10.5.3 Long-term (chronic) health risk:

Risk Summary: Long-term risk is **low** based on available data**.**

Medical Implications: None.

Confidence in the Risk Assessment: Confidence in assessment is **high** based on available data**.**

10.6 Burn Pit

While not specific to Ahmed Al Jaber Air Base, Kuwait, the consolidated epidemiological and environmental sampling and studies on burn pits that have been conducted as of the date of this publication have been unable to determine whether an association does or does not exist between exposures to emissions from the burn pits and long-term health effects (Reference 7).
The committee's review of the literature and the data suggests that service in Iraq or Afghanistan (i.e., a broader consideration of air pollution than exposure only to burn pit emissions) may be associated with long-term health effects, particularly in susceptible (e.g., those who have asthma) or highly exposed subpopulations, such as those who worked at a burn pit.

Such health effects would be due mainly to high ambient concentrations of PM from both natural and anthropogenic sources, including military sources. If that broader exposure to air pollution turns out to be relevant, potentially related health effects of concern are respiratory and cardiovascular effects and cancer.

Susceptibility to the PM health effects could be exacerbated by other exposures, such as stress, smoking, local climatic conditions, and co-exposures to other chemicals that affect the same biologic or chemical processes.

Individually, the chemicals measured at burn pit sites in the study were generally below concentrations of health concern for general populations in the United States. However, the possibility of exposure to mixtures of the chemicals raises the potential for health outcomes associated with cumulative exposure to combinations of the constituents of burn pit emissions and emissions from other sources.

10.6.1 Site-Specific Conditions:

Open-air burning of wood pallets and other wood waste occurred in a 10 foot by 10 foot burn box. Burning of paper was done in a 55 gal burn barrel. Both operations took place behind the Fire Department. Only wood and paper documents were allowed to be burned. No covered waste was permitted to be burned. The burning lasted from 0-2 hours as frequently as 0-1 times per week. Fire Department personnel were responsible for oversight of the burning.

10.6.2.2 Short-term health risks:

Risk Summary: Short-term risk is **low** based on available data and the associated health risk of burning limited quantities of wood and paper.

Medical Implications: None.

Confidence in the Risk Assessment: Confidence in assessment is **high** based on available data**.**

10.6.3 Long-term (chronic) health risk:

Risk Summary: Long-term risk is **low** based on available data and the associated health risk of burning limited quantities of wood and paper.

Medical Implications: None.

Confidence in the Risk Assessment: Confidence in assessment is **high** based on available data**.**

11 References

POEMS developed according to:

1. **DoDI 6490.03, *Deployment Health*, 2006.**
2. **JCSM (MCM) 0028-07, *Procedures for Deployment Health Surveillance,* 2007.**
3. **DoDI 6055.05, Occupational and Environmental Health, 2008.**
4. **Klaassen, C.D. *Casarett & Doull's Toxicology: the Basic Science of Exposures*, Chapter 2, Principles of Toxicology; Fifth Edition, McGraw Hill, New York.**

Site description and baseline information obtained from:

5. **Occupational and Environmental Health Site Assessment for Ahmed Al Jaber Air Base, Kuwiat, Survey ID: 236822, November 26, 2014**

Sampling data were obtained from the:

6. **Defense Occupational and Environmental Health Readiness System (referred to as the DOEHRS-EH database) at https://doehrs-ih.csd.disa.mil/Doehrs/. Some of the data may be classified or otherwise have some restricted distribution. See discussion below.**
7. **Military Exposure Surveillance Library: https://mesl.apgea.army.mil/mesl/. Some of the data and reports used may be classified or otherwise have some restricted distribution.**

Additional environmental health reports/survey documents are from the:

8. **Integrated Pest Management Plan – Multi-National Coalition Kuwait – January 23, 2006 Restricted link only from Armed Forces Pest Management Board, http://www.afpmb.org/**

9. **Kuwait – Ahmed Al Jaber Profile – GlobalSecurity.Org**
http://www.globalsecurity.org/military/facility/ahmed-al-jaber.htm

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

10. **USACHPPM June 2010 Revision, Technical Guide (TG230), "Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel". For further information, contact USAPHC Environmental Health Risk Assessment Program at: commercial 410-436-2953 or DSN 584-2953.**
11. **Department of the Army Technical Bulletin Medical (TB MED) 577, Sanitary Control and Surveillance of Field Water Supplies, TB Med 577, NAVMED P-5010-10, AFMAN 48-138, 1 May 2010.**
12. **USACHPPM, Particulate Matter Factsheet No. 64-009-0708, 2008.**

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

13. **Centers for Disease Control and Prevention (CDC) Travelers' Health website (http://wwwnc.cdc.gov/travel/destinations/traveler/none/XXXcountry), "Destinations" section, Kuwait.**
14. **U.S. AFCENT Pre-Deployment Medical Screening Procedures, 30 Jun 2014**
15. **Defense Intelligence Agency Infectious Disease Risk Assessment Database, CENTCOM: Kuwait (https://www.ncmi.detrick.army.mil/product/idra_db.php?co=KWT)**

The DOEHRS-EH database was queried to obtain the available sample data for air, soil, and drinking and nondrinking water sources at Ahmed Al Jaber Air Base, Kuwait. The data are currently assessed using the TG 230 June 2010 Revision as described above contains, the general method involves an initial check of the data which eliminates all chemical substances not detected above 1-year negligible MEG. Those substances screened out are not considered acute or chronic health hazards so are not assessed further. For remaining substances, acute and chronic health effects are evaluated separately for air and water (soil is only evaluated for long-term health risk). This is performed by deriving separate short-term and long-term population exposure level estimates (referred to as population exposure point concentrations (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 subject matter experts, which includes comparison to any available marginal, critical, or catastrophic MEGs. For drinking water, 15 liters/day (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 2L/day (similar to the US Environmental Protection Agency (USEPA)), which is derived by multiplying the 5-L/day MEG by a factor of 2.5. This value is used to conservatively assess nondrinking uses of water.

12 Where Do I Get More Information?

If a provider feels that the Service member's or Veteran's current medical condition may be attributed to specific OEH exposures at this deployment location, he/she can contact the Service-specific organization below. Organizations external to DoD should contact the Deputy Assistant Secretary of Defense (DASD) for Force Health Protection and Readiness (FHP&R).

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

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

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

DoD Force Health Protection and Readiness (FHP & R) Phone: (800) 497-6261
http://fhp.osd.mil