Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Muwaffaq Salti Air Base, Jordan
Calendar Years: January 2013 – 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) 0017-12 (*see References).*

PURPOSE: This POEMS documents the Department of Defense (DoD) assessment of Occupational and Environmental Health (OEH) risk for Muwaffaq Salti Air Base (MSAB), Jordan. This report also covers an Army Air Defense Artillery site which is located on MSAB. It presents a qualitative estimate of population-based health risks identified at this location and their potential medical implications. The report is based on information collected from January 2013 through 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.

This assessment assumes that environmental sampling at MSAB 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 2013 through July 2018.

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

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 MSAB 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 MSAB. 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.

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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 MSAB:

Air Quality: Fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) are present in the air at MSAB at moderate concentrations based on sample data collected. Samples collected during dust storms show concentrations above the short-term limit for critical effects. During routine (non-dust storm) periods, the majority of samples indicate concentrations below the negligible short-term limits. Some 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 resolved 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.

Food/Waterborne Diseases: If ingesting local food and water, health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (hepatitis A, typhoid fever, brucellosis). Risks from food/waterborne diseases are actively reduced with preventive medicine controls and mitigation, which includes hepatitis A and typhoid fever vaccinations, drinking and eating from approved sources in accordance with current USCENTCOM policy and providing medical intelligence briefings to all arriving personnel.

Non-Ionizing Radiation: MSAB has various sources of non-ionizing radiation, both electromagnetic frequency (EMF) radiation and laser radiation. The laser bore sighting of the MQ-1 and MQ-9 lasers pose significant health risks. Exposure to very high EMF radiation intensities can result in heating of biological tissue and an increase in body temperature resulting in tissue damage, especially to the eyes. Exposure to high laser radiation intensities can result in burns to the skin and eyes.

Heat Stress: For heat stress, moderate risk for susceptible persons including those older than 45, of low fitness level, un-acclimatized, or with underlying medical conditions. Risks from heat stress may have been reduced with preventive medicine controls, work-rest cycles, and mitigation.

Hazardous Noise: Hazardous noise sources are common on MSAB and include flight line noise, low-flying aircraft, generators, and maintenance/construction equipment. Hearing protection devices are not always available to those in the vicinity of hazardous noise producing equipment. Those operating hazardous equipment should use appropriate PPE. There is a moderate risk of temporary threshold shifts if proper controls are not followed.

Long-Term Health Risks & Medical Implications:

Exposures associated with the following environmental stressors may be associated with potential chronic health effects in some personnel after deployment at MSAB:

Air Quality: Fine particulate matter less than 2.5 micrometers in diameter (PM2.5) are present in the air in MSAB 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.

Non-Ionizing Radiation: MSAB has various sources of non-ionizing radiation, both electromagnetic frequency (EMF) radiation and laser radiation. The laser bore sighting of the MQ-1 and MQ-9 lasers pose significant health risks. Exposure to very high EMF radiation intensities can result in heating of biological tissue and an increase in body temperature resulting in tissue damage, especially to the eyes. Exposure to high laser radiation intensities can result in burns to the skin and eyes. Damage to the eyes can result in permanent partial or complete loss of eye sight or the formation of cataracts.

Hazardous Noise: Hazardous noise sources are common on MSAB and include flight line noise, low-flying aircraft, generators, and maintenance/construction equipment. Hearing protection devices are not always available to those in the vicinity of hazardous noise producing equipment. Those operating hazardous equipment should use appropriate PPE. There is a moderate risk of permanent threshold shifts if proper controls are not followed.

Table 2: Population-Based Health Risk Estimates – MSAB[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})	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 those not working in air conditioned spaces, time outdoors was minimized and tent flaps kept closed.	Short-term: **Low** For particulate matter, control measures have limited efficacy. Thus the residual risk may be similar or identical to unmitigated risk.
	Long-term: **Health guidelines not defined**.		Long-term: **Health guidelines not defined.**
Particulate matter less than 2.5 microns in diameter ($PM_{2.5}$)	Short-term: **Moderate** The majority of the time, no acute health effects such as eye, nose, or throat irritation from exposure is anticipated to occur. Mild acute (short-term) health effects are possible for those individuals who spent much of their time outdoors. Existing medical conditions (e.g., asthma or respiratory diseases) may be exacerbated.	Limit strenuous physical activities when air quality is poor. Minimize time outdoors, and keep doors, windows and tent flaps closed.	Short-term: **Moderate** Particulate matter 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 have been at increased risk of developing chronic health conditions. These conditions include reduced lung function, chronic bronchitis, chronic obstructive pulmonary disease (COPD), asthma, and other cardiopulmonary diseases. Those with a history of asthma or pre-existing cardiopulmonary disease had a higher risk for developing these chronic conditions.		Long-term: **Moderate** Particulate matter control measures have limited efficacy. Thus the residual risk may be similar or identical to unmitigated risk.
Airborne Metals	**Low** Particulate samples have shown trace amounts of Chromium, Manganese, Nickel, and Lead in the air.	Strenuous physical activities limited when air quality is poor; windows and doors are closed.	**Low** For metals associated with ambient dust, control measures have limited efficacy. Thus the residual risk may be similar or identical to unmitigated risk.
Volatile Organic Compounds (VOC)	**Low** No specific sources of VOCs have been identified that would impact the entire base population.	Locate open burning downwind of occupied areas of the camp. Fuel spills cleaned up quickly when they occur.	**Low**

Table 2: Population-Based Health Risk Estimates – MSAB[1, 2]			
Source of Identified Health Risk[3]	**Unmitigated Health Risk Estimate[4]**	**Control Measures Implemented[5]**	**Residual Health Risk Estimate[4]**
Soil			
Soil	**Low** No results over acceptable limits	Fuel spills cleaned up quickly if they occur.	**Low**
Water			
Consumed Water (Water Used for Drinking)	**Low** U.S. Army Veterinarian Command approved bottled water was provided for drinking.	U.S. Army Veterinary Command approved bottled water and ice. Active and ongoing drinking water surveillance program.	**Low**
Water used for other purposes (non-drinking)	**Low** Radium 226/228 and Total Dissolved Solids levels are above potability standards. However, since the water is not used for consumption, there is no effect on health. Alpha radiation cannot penetrate the dead layer of skin.	Water surveillance programs which routinely monitor for disinfectant residual and bacteriological contamination. Periodic sampling for radionuclides, metals, and other constituents.	**Low**
Military Unique			
Chemical Biological, Radiological Nuclear (CBRN) Weapons	**None identified**	Intel driven random sampling.	**None identified**
Depleted Uranium (DU)	**None identified**	N/A	**None identified**
Ionizing Radiation	**Low**	Area surveys are performed and radiation workers are enrolled in the dosimetry program.	**Low**
Non-ionizing Radiation	**Moderate** A few high hazard sources are present with significant hazard distances in close proximity to personnel.	Position antennas and lasers so they are only accessible to trained individuals, implement controlled areas and procedures to clear personnel when in use, angle direction of emissions away from personnel or toward barriers.	**Moderate**
Endemic Disease	Note: Residual risk for all categories is based on efficacy of control measure as evidenced by lack of disease(s) reported in various medical surveillance databases e.g, TMDS, MERS, DRSi.		
Gastrointestinal (e.g., diarrhea-bacteriological)	Short-term: **Moderate** 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: 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 Jordan and DNBI data from MSAB.
	Long-term: **Low** The majority of gastrointestinal diseases do not cause prolonged illness.		Long-term: **Low**

Table 2: Population-Based Health Risk Estimates – MSAB[1, 2]			
Source of Identified Health Risk[3]	**Unmitigated Health Risk Estimate[4]**	**Control Measures Implemented[5]**	**Residual Health Risk Estimate[4]**
Arthropod Vector Borne	Short-term: **Low**. Based on risk for all vector-borne diseases.	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, removal of vector harborages within camps, and the application of pesticides.	Short-term: **Low** For all vector-borne diseases based on disease incident reporting from Jordan.
	Long-term: **Low.** It is possible to be infected during deployment with leishmaniosis, but not to have a clinically evident disease until redeployed.		Long-term: **Low** Based on disease incident reporting from Jordan.
Water Contact (e.g. wading, swimming)	Short-term: **Low** The occurrence of flooding after heavy rainfall can facilitate the spread of leptospirosis already present in the soil	Avoidance of fresh water sources, such as puddles/ standing water, drainage areas, etc.	Short-term: **Low** Based on disease incident reporting from Jordan.
	Long-term: **None identified**		Long-term: **None identified**
Respiratory	Short-term: **Low** For tuberculosis and all 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**
	Long-term: **Low** The majority of respiratory diseases do not cause prolonged illness.		Long-term: **Low**
Animal Contact	Short-term: **Low** Based on disease incident reporting from Jordan.	Standard Preventive Medicine measures, as well as COCOM policy, 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**
	Long-term: **Low** Based on disease incident reporting from Jordan.		Long-term: **Low**
Venomous Animal/ Insects			
Snakes, scorpions, and spiders	Short-term: **Low** Based on encounters with venomous animals and insects.	Standard preventive medicine measures, such as the reduction of harborages for these animals, as well as education on how to avoid them (shake out boots before donning, etc.), reduce the risk of exposure.	Short-term: **Low**
	Long-term: **None identified**		Long-term: **None identified**

Table 2: Population-Based Health Risk Estimates – MSAB[1, 2]			
Source of Identified Health Risk[3]	**Unmitigated Health Risk Estimate[4]**	**Control Measures Implemented[5]**	**Residual Health Risk Estimate[4]**
Heat/Cold Stress			
Heat	Short-term: **Variable** Risk of heat injury in summer months is **moderate** for un-acclimatized personnel, while it is **low** the rest of the year.	Adequate periods of acclimatization for newly reporting or returning personnel. Adjustment of work-rest cycles based on monitoring of climatic conditions.	Short-term: **Variable**
	Long-term: **Low**		Long-term: **Low**
Cold	Short-term: **Low** Per measured seasonal 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 cold weather clothing Appropriate work/rest cycles during cold weather	Short-term: **Low**
	Long-term: **Low**		Long-term: **Low**
Noise			
Continuous	Short-term: **Moderate** There is potential risk for temporary hearing shifts due to excessive noise exposure.	Use of hearing protection. Labeling noise hazardous areas. Leadership enforcement of PPE use.	Short-Term: **Low** Based on control measures.
	Long-term: **Moderate** There is potential risk for permanent hearing damage due to repeated exposure to hazardous noise sources.		Long-Term: **Low** Based on control measures.
Impulse	Short-term: **Low**		Short-term: **Low**
	Long-term: **Low**		Long-term: **Low**
Unique Concerns			
Asbestos	**Low** Identified at Jordanian soccer facility.	Area made off-limits by the Installation Commander.	**Low**
Unique Incidents	**None identified**		**None identified**
Environmental Contamination	**Low**		**Low**
Pesticides/Pest Control	**Low**	PPE and performing operations during off-hours to minimize exposure potential.	**Low**
Burning Operations	**Low**	Burning limited to paper and only conducted on low-wind days.	**Low**

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Table 2: Population-Based Health Risk Estimates – MSAB, Jordan

[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 MSAB and other locations frequented by U.S. military personnel in the immediate vicinity of MSAB, Jordan. 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 a burn pit, which could result in a significant individual exposure. Any such person seeking medical care should have their specific conditions of exposure documented on Form SF600.

[2] This assessment is based on specific environmental sampling data and reports obtained from January 2013 through January 2017. Sampling locations are assumed to be representative of exposure points for the base 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 MSAB. 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 USA 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.

1 Discussion of Health Risks at MSAB, Jordan 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.

Table 2

2 Air

2.1 Area-Specific Sources Identified

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

MSAB's hot, dry climate results in very dusty conditions throughout the year. During the spring each year, Jordan is affected by Khamaseen dust cyclones from the North African Sahara. The days of notable sandstorms at MSAB were during seasonal changes. The Khamaseen dust over Jordan (to include in Azraq, Jordan) has been analyzed and found to be mostly subrounded to subangular and generally between 5 and 20 microns in size (based on research published by the University of Jordan). The dust samples were found to be composed of calcite, quartz, dolomite, feldspars and clay minerals. Calcite and quartz were the major constituents. Traces of Chromium, Manganese, Nickel, and Lead have been found in PM samples collected by USAF personnel, but did not exceed any of the respective 14 day or 1 year standards.

The sources that contribute significantly to air pollution are motor vehicles, oil refineries, open burning, mining and quarries. There is a small village about two miles away from MSAB. There were no industrial facilities present in the immediate vicinity of the MSAB. However, onsite electric power generation by numerous tactical generators (diesel and JP-8) located throughout the air base may have contributed air pollutants such as nitrogen oxide, carbon monoxide, hydrocarbons and particulates in their immediate vicinity. A burn barrel (January 2015 to July 2018) is used to dispose of personally identifiable information (PII) paper documents. Uniform burning had taken place but was halted IAW DODI 4715.19 in March 2015 and again in October 2016. Regular trash is removed by a local contracted agency.

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):
Negligible MEG=0.250
Marginal MEG=0.420
Critical MEG=0.600

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

2.3.2 Sample data/Notes:

A total of two valid PM_{10} air samples were collected at MSAB in 2013. The range of 24-hour PM_{10} concentrations was 0.072 mg/m^3 – 0.164 mg/m^3 with an average concentration of 0.118 mg/m^3. In the published scientific literature, ambient air samples collected near a quarry between Amman, Jordan and Zarqa, Jordan had an average PM_{10} concentration of 0.63 mg/m^3 in 2005 (Abu-Allaban et al., 2006). Personnel at MSAB may drive past quarries at times, but are not exposed to these extreme dust concentrations on a regular basis.

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

Approach: To assess acute risk associated with PM_{10}, the peak concentrations were used to arrive at the acute risk. The peak concentration was intended to represent the worst exposure conditions. Both of the two available samples were below the 24-hour negligible MEG. Based on the two samples, the acute health risk is **low**.

Risk Summary: **Low**

Medical Implications: At the low risk level, a small number of individuals may have experienced eye, nose, and throat irritation and sought medical attention assuming the levels detected during the limited sampling are representative of general environmental conditions. In most of these individuals, the symptoms would have been mild and temporary requiring no medical treatment. During periods when airborne dust concentrations were higher than those detected, more individuals may have been affected and the severity of symptoms increased. It is likely that more individuals may have sought medical attention with higher airborne dust concentrations. Symptoms associated with exposure to PM_{10} would be expected to resolve after exposure ceased. Health effects in persons with pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.

Confidence in the Risk Assessment: Confidence in the risk assessment is **low** based on the limited PM_{10} air sampling data available. Since dust storms are known to occur in Jordan and around MSAB, the sampling results may not reflect the most acute risk.

2.3.4 Long-term (chronic) health risk for PM_{10}:

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):
Negligible MEG=0.065
Marginal MEG=0.250
Critical MEG=0.500

Long-term (1year) $PM_{2.5}$ MEGs (mg/m3):
Negligible MEG=0.015
Marginal MEG=0.065

2.4.2 Sample data/Notes:

From 2013 to 2016, 38 valid ambient air $PM_{2.5}$ samples were collected at MSAB. In 2013, the concentrations of 2 samples were 0.034 mg/m^3 – 0.042 mg/m^3 with an average concentration of 0.038 mg/m^3. In 2014, the concentrations of two samples were 0.010 mg/m^3 and 0.048 mg/m^3 with an average $PM_{2.5}$ concentration of 0.029 mg/m^3. In 2015, the range of concentrations from 21 samples was 0.017 mg/m^3 —0.700 mg/m^3 with an average concentration of 0.069 mg/m^3. The sample with the highest concentration in 2015 was taken during a dust storm. In 2016, the concentrations of 10 samples were 0.014 – 0.044 mg/m^3 with an average $PM_{2.5}$ concentration of 0.026 mg/m^3. The overall average concentration of $PM_{2.5}$ was 0.053 mg/m^3.

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

Approach: To assess acute risk associated with $PM_{2.5}$, the peak concentrations were used to arrive at the acute risk. The peak concentration was intended to represent the worst exposure conditions. One sample in 2015, taken during a dust storm, was above the 24-hour Critical MEG. Of the other 37 samples taken at MSAB, 1 has been above the Marginal MEG of 0.250 mg/m^3 and 2 more were above the Negligible MEG of 0.065 mg/m^3. 87% of samples analyzed were below the Negligible MEG.

Risk Summary: Moderate

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. However, the risk for these chronic conditions is likely overstated for individuals who did not work outdoors 8-12 hours per day

Confidence in the Risk Assessment: Confidence in the risk assessment is **high** based on the amount of $PM_{2.5}$ air sampling data and sampling during various weather conditions and times of year.

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 approximately twelve months. Three samples were over the long-term 1-year Marginal MEG of 0.065, however, the overall average of all 38 samples was 0.053 mg/m3, which is below the long-term MEG.

Risk Summary: Moderate

Based on average $PM_{2.5}$ sample concentration, as compared with the long-term 1-year Marginal MEG (0.065 mg/m^3), the long-term health risk assessment for $PM_{2.5}$ sample concentrations and the likelihood of exposure at these levels, health risk hazard is **moderate**.

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. However, the risk for these chronic conditions is likely overstated for individuals who did not work outdoors 8-12 hours per day.

Confidence in the Risk Assessment: Confidence in the risk assessment is **high** based on the amount of $PM_{2.5}$ air sampling data and sampling during various weather conditions and times of year.

2.5 Airborne Metals

2.5.1 Sample Data/Notes:

From 2013 through 2016, metals analysis was performed on 38 ambient air particulate matter samples (including PM_{10} and $PM_{2.5}$) collected at MSAB. No metals (i.e., antimony, arsenic, beryllium, cadmium, chromium, lead, manganese, nickel, vanadium, and zinc) were detected above their corresponding military exposure guidelines (MEGs). Chromium, lead, manganese and nickel were detected above the limit of quantification (LOQ).

Risk Summary: Low

All metals detected were below their respective MEGs.

2.5.2 Short-term (acute) health risk:

No short-term health risk was identified based on available sampling data.

2.5.3 Long-term (chronic) health risk:

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

Confidence in the Risk Assessment: Confidence in this risk assessment is **high** based on available sampling data. These metals would not be expected to be at high levels in the ambient air unless there was an industrial operation nearby causing the release of these metals.

2.6 Volatile Organic Compounds (VOC)

2.6.1 Sample Data/Notes:

From 2013- 2015, 12 valid air samples were collected at MSAB for VOC analysis. Two samples in December 2014 were positive for acrolein at 2.6 µg/m^3 and 1.2 µg/m^3, which are above the 1-year Negligible MEG of 0.137 µg/m^3. One sample in September 2013 was positive for methylene chloride at 1065 µg/m^3, which is above the 1-year Negligible MEG of 713 µg/m^3. All the other VOC results were below the MEGs.

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

2.6.3 Short-term (acute) health risk of VOCs*:*

Approach:
For screening purposes, peak and average concentrations of all airborne VOCs detected were compared to their corresponding short-term, 1-hour MEGs. Short-term risk estimates based on the USAPHC TG 230 methodology are determined for any compound detected at a concentration greater than its 1-hour.

Risk Summary: **Low**

No parameters exceeded the short-term MEGs.

Medical Implications: None expected at the concentration measured.

Confidence in the Risk Assessment: Low based on the number of samples taken, variability of results and the laboratory's limited capability to quantify some VOC compounds.

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

Approach:
For screening purposes, sample results for each detected VOC were compared with each of the corresponding long-term, 1-year MEGs as published in the USAPHC TG 230.

Risk Summary: Low

The long-term health risk is low because there is no known source contributing to regular exposure. The risk of intermittent exposure at the concentrations detected is negligible. The sampled concentrations generally will not be representative of possible exposures to the entire base population. Rather they only represent the population residing or working in proximity to the sample location.

Medical Implications: Chronic effects would not be expected since there was no evidence to suggest that VOC exposures over the MEGs was a regular event. Animal studies have shown that breathing acrolein causes irritation to the nasal cavity, lowered breathing rate and damage to the lining of the lungs. Methylene chloride is a probable human carcinogen and mild exposure causes varying degrees of inebriation, headache, lightheadedness, weakness, irritability and nausea.

Confidence in risk estimate: **Moderate** based on the number of samples taken, variability of results and the laboratory's limited capability to quantify some VOC compounds.

Table 2

3 Soil

3.1 Site-Specific Sources Identified

3.1.2 Sample Data/Notes*:*

Six soil samples from MSAB have been collected and analyzed in 2014 and 2015. Two samples were taken on the LSA, one at the Patriot Site and three by leaking underground RJAF fuel tanks near the LSA NW Expansion. All sample results were well below established MEGs.

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 contaminants. These individuals comprise a relatively small proportion of the overall base population.

3.1.3 Short-term (acute) health risk for soil: Soil is not evaluated as a short-term (acute) risk.

3.1.4 Long-term (chronic) health risk for soil:

Approach: For long-term health risk, sample results were compared with each of the corresponding long-term MEGs. Long-term risk estimates were based on the probability of exposure to the concentrations detected.

Risk Summary: Low based on available data, as no samples are above the corresponding MEGs.

Medical Implications: None expected at the concentration measured.

Confidence in risk estimate: **Moderate** based on the number of samples collected and the consistency of results. Certain discrete locations may have elevated concentrations of soil contamination.

4 Water

4.1 Site-Specific Sources Identified

Commercial bottled water constitutes the majority of water used for drinking and food preparation on MSAB. The water provided for non-drinking use comes from the Jordanian aquifer. The water is pumped by a Jordanian well to a storage reservoir, where it is then pumped to the LSA. This water supply was approved to be used for personal hygiene such as hand washing, showering, and laundering clothing, cleaning, and washing dishes. Prior to April 2014, the non-potable water was used for food preparation and a disinfectant was used for vegetable washing. As of June 2015, a chlorinator was installed to treat the non-potable water system. There is one Reverse Osmosis (RO) unit installed at MSAB and it provides potable water for the Green Beans Cafe. The non-potable water system is not approved for consumption, brushing teeth or food preparation due to total dissolved solids (TDS) and Radium-226/228.

4.2 Consumed Water (Water for drinking or cooking consumption)

4.2.1 Sample Data/notes:

Bottled water from approved sources is used for the majority of drinking water at MSAB. Every lot that is received is tested for the presence of Total Coliforms and *E.coli* prior to distribution and consumption. Over 2013-2018, there has been two lots of water, in March 2014 and May 2018 that tested positive for Total Coliforms. All water from these lots were destroyed and the use of these manufacturers was discontinued.

Based on sampling results from October 2014, the Reverse Osmosis (RO) unit installed at the Green Beans Café effectively removes the Total Dissolved Solids (TDS) and radiologicals present in the non-potable water distribution system (see 4.3.1). TDS was measured to be 12 mg/L, gross alpha activity was 0.25 pCi/L and gross beta activity was 0.3 pCi/L. The next sample was taken on 31 August 2016. In this sample, TDS was measured to be 390 mg/L, gross alpha activity was 17 pCi/L and gross beta activity was 6.9 pCi/L. These radiological activities exceeded the military long-term potability standards. Use of the RO water was suspended until the unit was shown to be functional by direct TDS readings in November 2016. It is unknown at what point between October 2014 and August 2016 the RO unit's performance began to degrade. TDS monitoring since November 2016 has been incorporated into the routine monthly testing. None of the post-treatment TDS sampling for 2017 had levels above 500 mg/L which is the Environmental Protection Agency's limit for the general public. A treated water kit was collected 14 May 2018, TDS was measured to be 35 mg/L, gross alpha activity was 0.25 pCi/L and gross beta activity was 0.66 pCi/L, all below military LTP standards.

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

Approach: Health risk is from bacterial contamination is precluded by effective sampling and preventing the distribution of contaminated water.

Risk Summary: **Low.** All sampling since March 2014 has been negative for Total Coliform and *E. coli*. Procedures are in place to prevent the distribution of contaminated water. Although the Green Beans Café water was measured to exceed potability standards at one time, it is unlikely anyone consumed enough water to have a significant health impact.

Medical Implications: Health symptoms related to drinking or swallowing water contaminated with bacteria generally range from no ill effects to cramps and diarrhea (gastrointestinal distress). Coliform or other bacteria in drinking water will not necessarily make a person ill; however, if these organisms are present, other disease-causing organisms may also be present. *E. coli* 0157: H7 has also been associated with drinking contaminated water and can cause intestinal illness. In very rare cases, it can cause hemolytic uremic syndrome, a serious kidney condition.

Confidence in the Risk Assessment: Confidence in the risk assessment is **high** because of the number of samples for each lot. Also, US Army veterinary personnel performed regular audits of all bottled water suppliers to ensure consistency of quality.

4.3 Water for Non-Drinking/Other purposes

Non-potable water used for non-drinking purposes comes from a Royal Jordanian AF operated well. As of June 2015, all distribution water on the LSA is disinfected and used for personal hygiene and showering. Water at remote sites comes from the same source and is delivered by contractor. However, the contractor delivered water is inconsistently disinfected.

4.3.1 Sample Data/notes:

From July 2013-Present, non-potable water has been regularly sampled and tested for Total Coliform and *E. coli*. Samples were taken from points at the LSAs chlorine treated water system and the contract filled locations. Prior to the installation of the chlorination system, there were 15 samples from these non-potable sources that tested positive for total coliforms. The positive samples were from all over MSAB and happened in clusters. No positive results have been seen with proper chlorination. However, contractor delivered water at remote sites occasionally are positive for Total Coliform, once in 2016 at the Air Defense Artillery latrine and twice in 2017 at the Reaper Land latrine.

From 2014-2017, 25 samples were taken from the non-potable water system and source. The samples averaged 31 picocuries per liter (pCi/L) of gross alpha activity, exceeding the TB MED 577 military long-term potability standard of 15 pCi/L for gross alpha activity. The samples averaged 10.85 pCi/L for radium-226, exceeding the military long-term potability standard of 5 pCi/L for combined radium. The samples averaged 12.48 pCi/L for gross beta activity. Although the results for gross beta activity exceeded the drinking water screening criteria, gamma spectrometry analyzes for Bismuth-212, Bismuth-214, Cesium-137, Lead-212/214, and Polonium-210 did not indicate a specific hazard. Total Dissolved Solids averaged 556.25 mg/L and all samples exceeded the military long-term potability standard of 500 mg/L.

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:

- Bottled water was used for cooking and drinking, and well water was used for personal hygiene purposes.
- The primary routes of exposure associated with the municipal water were dermal contact and incidental ingestion while conducting personal hygiene.
- MSAB residents ingest far less than two liters (during personal hygiene) of non-potable water per day. When showering, little to no water would be expected to be ingested, and the radiation dose absorbed by the skin is very small, equating to less than 1 millirem per year.

Risk Summary: Low –given the amount of non-potable water incidentally ingested, the amount of contaminants ingested is much less than the basis of the long-term potability standard. During 2013, the water was used for food preparation but there were no known illnesses attributed to this use. Bottled water was used for food preparation beginning in January 2014. The concentrations of alpha and beta activity would not be expected to cause a health effect based on the expected non-potable uses of the water. The alpha and beta radiation cannot penetrate the skin and contribute no dose when external to the body.

Medical Implications: None expected given the water uses and the concentrations measured.

Confidence in the Risk Assessment: **Moderate** - Confidence in the risk assessment is **Moderate** due to the number and consistency of samples and the inconsistent disinfection methods used for contractor-delivered 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 of this report.

5.2 Depleted Uranium (DU)

There were no specific hazard sources or exposure incidents documented in DOEHRS or the MESL during the period of this report.

5.3 Ionizing Radiation

The Nondestructive Inspection (NDI) shop performs x-ray inspections in an approved non-shielded location and are enrolled in the Thermoluminescent Dosimetry (TLD) program. Prior to 2016, NDI utilized the Royal Jordanian Air Force NDI facility. EMEDS personnel perform x-rays on patients intermittently. Explosive Ordnance Disposal (EOD) may perform munitions inspection utilizing a mobile x-ray tube. Security Forces personnel perform x-ray surveillance of vehicles using a VACIS GT system and/or a backscatter x-ray system as they are entering the vehicle search area. The VACIS GT system has an Army-licensed Cobalt-60 source. The operators are enrolled in the TLD program.

5.3.1 Short and long-term health risks: **Low**. Procedures are in place to maintain exposures as low as reasonable achievable.

Medical Implications: No health effects are anticipated if personnel continue to use time, distance and shielding controls.

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

5.4 Non-Ionizing Radiation

MSAB has various sources of non-ionizing radiation, both electromagnetic frequency (EMF) radiation and laser radiation. EMF sources include aircraft radar, antennas, and satellite dishes. Hazardous lasers include aircraft targeting lasers, Security Forces IR aiming lasers, and industrial use lasers.
5.4.1 Short and long-term health risks: **Moderate** based on available information. The parameters of the EMF sources have been reviewed, and a hazard distance has been calculated for them. Hazard distances for most significant EMF sources have been verified with survey instruments. Laser use and controls have been evaluated. The laser bore sighting of the MQ-1 and MQ-9 lasers pose significant health risks. Controls were re-engineered and implemented between February and July 2018 to provide adequate protection for personnel working in the area.

Medical Implications: Exposure to very high EMF radiation intensities can result in heating of biological tissue and an increase in body temperature. Tissue damage in humans could occur during exposure to high radiation levels because of the body's inability to cope with or dissipate the excessive heat that could be generated. The eyes are particularly vulnerable to heating because of the relative lack of available blood flow to dissipate the excess heat load. Exposure to high laser radiation intensities can result in burns to the skin and eyes. Damage to the eyes can result in permanent partial or complete loss of eye sight or the formation of cataracts.

Confidence in the Risk Assessment: **Moderate**. Assessments and surveys of the hazard distances for the various antennas have been conducted. The hazard distances range from 302 feet to near zero feet away from the antennas. Administrative and engineering controls have been implemented for laser radiation. Due to the use of hazard distances and other administrative controls, the risk of over-exposure is Moderate.
Table 2

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 Center (AFHSC) maintains archives of medical event reports for all Services.

Jordan medical event reports 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 Jordan were assessed by referring to the World Health Organization's Jordan Communicable Disease Profile and the "Destinations" section of the Centers for Disease Control and Prevention (CDC) Travelers' Health website, http: //wwwnc.cdc.gov/travel/destinations/clinician/none/Jordan. In addition, TRAVAX and the National Center for Medical Intelligence were also used to identify endemic diseases.

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 Jordan are assumed not to represent all cases of reportable endemic disease events among service personnel deployed to Jordan.

6.2 Gastrointestinal Diseases

U.S. Service members have little or no immunity to the food and waterborne diseases present in Jordan. To prevent food and waterborne diseases among individuals deployed to Jordan, food and water are purchased from approved sources. Members are briefed on food safety precautions to be taken if local food and or water must be ingested. 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, berthing, bathroom facilities, and working spaces.

Approach: The health risk from gastrointestinal infections and endemic food and waterborne diseases to individuals deployed to Jordan 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 Jordan, and review of military public health reports.

6.2.1 Short -term health risks*:*

Risk assessment: The short-term risk associated with food borne and waterborne diseases in Jordan was **moderate** (bacterial or viral gastroenteritis, protozoal diarrhea, cholera, brucellosis, hepatitis E).

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

Confidence in the Risk Assessment: Moderate 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: Low for protozoal diarrhea and brucellosis, since illnesses are temporary in nature.

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

Confidence in the Risk Assessment: Moderate Incidences of protozoal diarrhea and brucellosis in the post-deployment military population is known to be extremely rare.

6.3 Arthropod Vector-Borne Diseases

The climate and ecological habitat found around MSAB are not conducive to large arthropod vector populations, such as mosquitoes, ticks and sand flies. Risk is higher in urban and other densely populated areas, or near where animals are kept.

Approach: The health risk for endemic vector-borne diseases to individuals deployed to Jordan 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 areas, and review of military public health reports.

6.3.1 Short-term (acute) health risks:

Risk assessment: Short-term risk for the vector-borne diseases sand-fly fever, West Nile Fever, Crimean-Congo hemorrhagic fever, tick-borne Rickettsioses, and visceral/cutaneous leishmaniosis was assessed to be **low**. Individuals who deploy from MSAB, and/or supported base camps, to urban or rural outlying areas may experience increased short-term risk. There have been no reported cases from personnel deployed in Jordan. There is no current risk of malaria in Jordan.

Medical Implications: Sand-fly fever, West Nile Fever, Crimean-Congo hemorrhagic fever, tick-borne Rickettsioses, typhus, and plague present in Jordan 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. Visceral leishmaniosis, while assessed as present, is extremely rare and can have an incubation period from 10 days to 6 months. 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 **high** given the low populations of vectors and absence of diagnosed cases.

6.3.2 Long-term (chronic) health risks:

Risk assessment: Low for the long-term risk for arthropod vector-borne diseases**.** 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 aware of the presence of leishmaniosis in Jordan, and skin lesions in individuals with a history of time spent in Jordan were/are evaluated with that in mind.

Medical Implications: Both visceral and cutaneous leishmaniosis may have extended incubation periods, ranging from 1 week to 6 months. 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.

Confidence in the Risk Assessment: Confidence in the risk assessment is **Moderate** due to lack of data available on the post deployment incidents.

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 Jordan 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 Jordan, and review of military public health reports.

6.4.1 Short-term (acute) health risks:

Risk assessment: The short-term risk for leptospirosis and schistosomiasis was **low**. Personnel do have the potential to engage in recreational water activities but there have been no reported cases of leptospirosis or schistosomiasis from Jordan.

Medical Implications: Leptospirosis, which has an incubation period of 5-14 days, presents as an acute fever with nonspecific symptoms that last for 1 week to several months. Schistosomiasis is a febrile illness that has in incubation period of 14 to 42 days, and in severe cases, can require hospitalization and convalescence for 7 days.

Confidence in the Risk Assessment: High. No reported cases of water contact diseases were identified from Jordan 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. Meningococcal meningitis should also be considered in close quarters.

Approach: The health risk for respiratory diseases to individuals deployed to Jordan 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 Jordan, 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. Middle Eastern Respiratory Syndrome Coronavirus (MERS-CoV) is endemic in the Middle East and present in Jordan.

The short-term risk for tuberculosis and MERS-CoV was **low.** Most cases of MERS-CoV are healthcare associated and occur among healthcare workers in civilian medical facilities.

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.

Most people infected with MERS-CoV developed severe acute respiratory illness, including fever, cough, and shortness of breath.

Confidence in the Risk Assessment: Moderate. 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 low/un- assessed. No reports of tuberculosis were identified for individuals deployed to Jordan 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: 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 Jordan were not routinely vaccinated against vaccine preventable diseases such as rabies or anthrax. Q-fever, anthrax, avian influenza, and rabies are known to be present in Jordan. Exposure to animals, and/or locations where animals were kept (stray dogs/cats, camels, birds, barnyards, poultry houses, slaughter houses), 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, and avoidance of close contact to prevent exposure to MERS-CoV (camels) and avian influenza (birds and poultry).

Approach: The health risk for endemic animal contact diseases to individuals deployed to Jordan 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 Jordan, and review of military public health reports.

6.6.1 Short-term (acute) health risks:

Risk assessment: The short-term risk for anthrax (naturally acquired), avian influenza (H5N1), rabies and Q-fever was **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 if untreated.

Most people infected with MERS-CoV developed severe acute respiratory illness, including fever, cough, and shortness of breath. Camels have tested positive for MERS-CoV and are thought to be carriers of the virus. As a precaution, personnel are instructed to avoid any close contact with camels.

Cases of avian influenza (H5N1) in Jordan are extremely rare and have only been reported in poultry.

Confidence in the Risk Assessment: High.

6.6.2 Long-term (chronic) health risks:

Risk assessment: The long-term risk for Q-fever and rabies was **low**.

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 in rare instances.

Confidence in the Risk Assessment: High.

7 Venomous Animals/Insects

The species listed below have home ranges that overlap the country of Jordan, 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 Jordan) 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 Jordan. The Black Widow Spider (*Latrodectus lugubris*) is the only 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.

7.1.2 Scorpions: Numerous species of scorpion are found in Jordan. The majority of scorpions found in the region have stings that cause only short lived local effects, such as pain, without systemic effects. Serious envenomation 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 Jordan and have known detrimental health effects:

- *Leiurus Quinquestiatus* (Yellow Deathstalker) venom is a powerful mixture of neurotoxins, with a low lethal dose. While a sting from this scorpion is extraordinarily painful, it normally would not kill an otherwise healthy adult human. Anti-venom available in Amman.
- *Androctonus crassicudauda (*Arabian Fat-Tail). Some authorities report a sting from a Black Fat tail Scorpion can kill an adult human in seven hours. Reactions vary considerably. Anti-venom available in Amman.
- *Leiurus jordanensis (*Jordan's Black Deathstalker) venom is the most powerful and the most painful and can kill children and elderly people. Anti-venom available in Amman

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

7.1.3 Snakes: Numerous species of snakes are found in Jordan. A number of poisonous snakes, whose range incorporates Jordan, could have been encountered to include cobras, pit vipers, and vipers. The following list is not an all-inclusive list of snakes in the area. Most of the data is derived from a Systemic, distribution and ecology of snakes study done by the Department of Biology, Jordan University of Science & Technology and Department of Biology, the University of Jordan, Amman and represent those deemed most significant or potentially encountered.

- *Antractaspis Engaddensis* (Israeli Mole Viper). Highly Lethal without intervention, Neurotoxic, Cardiac Distress, A-V Block, may cause: extreme locational pain, anticoagulation, lowered BP, respiratory distress. Antivenin available in Amman.
- *Cerastes gasperettii (*Arabian Horned Viper). Procoagulant, Hemorrhaging, Abdominal Pain, Vomiting, Dizziness, Convulsions, Headaches, Site swelling and necrosis. Morbidity is less than 1% with intervention. Antivenin available in Amman.
- *E. Coloratus* (Burton's Carpet Viper) Procoagulant, Anticoagulant, Hemorrhaging, Nephrotoxic, Necrotoxins. 10% morbidity with intervention. Antivenin available in Amman.
- *Vipera palaestinae/Daboia palaestinae (*Palestine Viper, Pit Viper). Vomiting, Swelling at site, Sweating, Abdominal Pain, Diarrhea, Tachycardia, Facial Swelling, Hypotension, Shock. Antivenin available in Amman.
- *Walterinnesia Aegyptia* (Desert Black Snake) Data for the Desert Black Snake is low, common antivenin is recommended however no known antivenin specifically for this snake.

Overall, the health risk associated with snakes was **low**.

7.2 Long-term (chronic) health risk: **No long-term health risks were identified based on available data.**

8 Heat/Cold Stress

8.1 Site-Specific Conditions:

Jordan has a hot, dry climate characterized by long, hot, dry summers and short, cool winters. The climate is influenced by Jordan's location between the subtropical aridity of the Arabian Desert areas and the subtropical humidity of the eastern Mediterranean area. January is the coldest month, with temperatures from 5°F (40°C) to 10°F (50°C), and August is the hottest month at 68°F (20°C) to 95°F (35°C). Daily temperatures can be very hot, especially in the summer; on some days it can be 104°F (40°C) or more, especially when the Shirocco, a hot, dry southerly wind blows. These winds can sometimes be very strong and can cause Sandstorms. Winds are normally out of the northwest and can get up to 25-29 knots.

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: Only one case of heat exhaustion from July 2017 was present in a review of DNBIs reported to AFCENT. No other 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 MSAB. Accordingly, risk estimates are based primarily on historical weather data.

Risk Summary:

Short-term (acute) health risk: **Variable**. **Moderate** health risk of heat injury for un-acclimatized individuals (i.e. on site less than four weeks) from May-September were moderate. For the remainder of the year, health risk was **low**. Health risk for persons with underlying health conditions may be elevated above these baselines, especially during May-September.

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: Moderate based on generally available information on climatic conditions and the absence of reported heat injuries. 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 is available. Therefore, risk estimates are based strictly on existing climatologic data.

Risk Summary: Short- and long-term health risks are **Low**. 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**.** The risk of cold stress/injury increases with colder temperatures, wind, longer exposures, inactivity, and inadequate clothing.

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: High - 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 Air Force has established an occupational and environmental exposure limit (OEEL) for continuous or intermittent noise at 85 decibels on the A-weighted scale (dB(A)), 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 OEEL be enrolled in the hearing conservation program.

9.1.2. Site Specific Conditions:

Sources of potential noise include flight line operations, associated with aircraft, tactical generators, and various tools used for maintenance and construction. Due to the inherent noise hazard in flight line operations, personnel were required to wear hearing protection.

9.1.3 Short (acute) and long-term (chronic) health risk: **Moderate** based on available information.

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

Risk Summary:

Short-term health risk: There is a **moderate** risk of temporary threshold shifts due to excessive noise exposure. The short-term risk of noise injury with appropriate hearing protection use is **low**.

Long-term health risk: The long-term risk of noise induced hearing loss with appropriate hearing protection use is **moderate**. Personnel are exposed more than the typical home station work periods of 40 hrs/week which increases risk. In addition, flight line noise levels can peak at 110.5 dBA for the general area with a TWA of 106.3 dBA for maintenance personnel working near aircraft engines. Personnel near generators can also get exposures between 92.8 and 109 dBA.

Medical Implications: Exposure to high noise levels can cause hearing loss, tinnitus (ringing in the ear), stress, high blood pressure, fatigue and gastro-intestinal problems.

Confidence in the Risk Assessment: Confidence in the health risk assessment is **moderate**. Hearing protection is available for individuals with known occupational exposures. However, the limited enforcement of the use of personal protective equipment diminishes confidence.

9.2 Impulse

At this time, there is no measured information of impulse noise (140 dB or greater) available for MSAB. Impulse noise exposure is typically associated with the discharge of weapons, which does not occur here as there have not been hostile action at this location. There is a Royal Jordanian AF firing range, but it is not used by USAF personnel and is not located near the LSA. The range is outdoors and has a sand berm. All Security Forces weapons sighting occurs before deployment. Before January 2017 Security Forces (SF) and personnel issued weapons used the Royal Jordanian AF firing range for sighting weapons, though based on frequency and duration of firing ops, the impact of the impulse noise hazard would have been minimal.

9.2.1 Short-term (acute) and Long-term (chronic) health risks: **Low** – Personnel have hearing protection available. There is no information to suggest that the exposure to impulse noise at the firing range was any more than at home station. There are no known cases of exposure to impulse noise at this location after January 2017.

Medical Implications: Exposure to high noise levels can cause hearing loss, tinnitus (ringing in the ear), stress, high blood pressure, fatigue, and gastro-intestinal problems.

Confidence in the Risk Assessment: **High**

Table 2

10 Unique Concerns

10.1 Asbestos

10.1.1 Site-Specific Conditions:

The majority of facilities utilized by US personnel on MSAB are temporary in nature. There are some buildings that were provided for use by the Host Nation. Bulk sampling that was conducted at the AMU building was negative for asbestos. There are no other suspected exposed asbestos materials in any occupied building. The Royal Jordanian AF owns an indoor soccer facility that some US personnel have used for recreation in the past. Sampling has shown that the roof/ceiling material consists of 35% chrysotile asbestos. The roof is in disrepair with visible holes and sections missing. In November 2016, a policy letter was published by the Installation Commander stating that the soccer facility was to be off-limits to all US personnel.

10.1.2 Short-term and long-term health risk: **Low** based on available information.

Medical Implications: Symptoms of asbestos-related diseases, such as shortness of breath, coughing, and chest pain, often do not appear until 20 to 50 years after the exposure. The two types of cancer caused by exposure to asbestos are lung cancer and mesothelioma.

Confidence in the Risk Assessment: **Moderate.** Not all occupied buildings have been completely assessed for asbestos hazards. As work order requests for these buildings come in, the areas are being assessed for hazards before work begins.

10.2 Unique incidents at the site/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 any form of waste. Hazardous medical waste (red-bagged or sharps containers) generated by the medical group is disposed of via contractor with the hazardous industrial waste. Hazardous industrial waste is accumulated at a location north of the LSA. A contractor quarterly comes to pick up and dispose of the waste.

Non-hazardous solid waste generated by base residents is disposed of in various trash bins throughout the base. The trash bins are emptied by Force Protection personnel and removed through a host nation contractor.

Sewage/latrine waste is collected in sub-surface tanks near the point of generation. These tanks are located across the LSA and in the remote work areas on MSAB. Contractors empty the tanks twice daily. In hot, summer months, the tanks can generate strong odors. Once pumped out, the waste is taken to a Jordanian lift station and is pumped to a dilapidated treatment plant between the runways. The waste is collected in a makeshift lagoon. Personnel do not occupy this area and there are few individuals who go there.

Portable chemical latrines 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 based on available data.

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

10.3 Environmental Contamination

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. Workplaces with hazardous materials include but are not limited to the Vehicle Maintenance shop, Sheet Metal Repair shop, and Fuel System Repair shop. Small spills (less than 100 gallons) of antifreeze, engine oil, hydraulic fluid, and fuel (gasoline/diesel) are known to have occurred at MSAB. Fuel is stored in large bladders, and there have been no instances of the bladders bursting.

Approach: Knowledge of the U.S. Central Command and Service specific policies and procedures served as the basis of this risk assessment. The qualitative information such as the similar exposure group (SEG) descriptions in DOEHRS-IH was reviewed.

Risk Summary: Short- and long-term health risk is **low** based on available information.

Medical Implications: None based on available data.

Confidence in the Risk Assessment: Confidence in the risk assessment is **Moderate**. There is not any quantitative data on exposure and spills are known to have occurred in the past. Personnel have been trained at their home station on how to use personal protective equipment (PPE). PPE was available and presumed to have been used correctly during routine shop operations and during the response to the spills.

10.4 Pesticides/Pest Control:

There is an entomology specialist on MSAB. They mitigate pests and vectors in accordance with mandated integrated pest management practices and in accordance with DoDI 4150.07 requirements. The overwhelming majority of those efforts at the air base were in the reduction of filth flies, rodents, and feral animals. Non-chemical measures such as exclusion measures, sanitation and various animal trapping methods were first and primary efforts. Secondary measures included the use of targeted bait applications for flies and rodents and mild store bought pesticides for insects. No organophosphates were used.

Risk Summary: Short- and long-term health risk is **low**. Only minor solid/granular pesticides are typically used and protective measures are to be followed if more robust methods must be used.

Medical Implications: No health effects anticipated.

Confidence in the Risk Assessment: Confidence in the risk assessment is **high** since mild pesticides were used with PPE at all times. There is no information to suggest any issues with the pest management practices performed.

10.5 Burning Operations

10.6.1 General Information:

While not specific to MSAB, 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.

10.6.2 Site-Specific Conditions:

MSAB did not operate a burn pit; however, a burn barrel was used to discard sensitive paper/documents. There is documentation indicating that uniform items and boots were burned. This practice was halted in February 2015

and again in October 2016.

Additionally, a medical incinerator was acquired and used during the Jan-Jul 16 rotation. The incinerator was located approximately 50 ft upwind from living quarters and about 150 ft upwind from the DFAC. As of 2018 the incinerator is no longer at MSAB and there are no plans to procure a new one as an alternative disposal method. All medical waste has been contracted out for disposal.

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

Medical Implications: Inhalation of smoke and combustion products may cause irritation of the eyes, throat and respiratory tract. It may lead to shortness of breath and can worsen medical conditions such as asthma and heart disease.

Confidence in the Risk Assessment: Confidence in the risk assessment is **low** since combustion products have not been sampled.

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. **14th Weather Squadron, "Jordan Full Year Climatology," https: //www.afccc.af.mil/**
6. **Med-O-Med, "Jordan – Physical Geography Data," http: //medomed.org/2010/jordan-physical-geography-data/**
7. **Food and Agriculture Organization of the United Nations, "Jordan," http: //www.fao.org/ag/AGP/AGPC/doc/counprof/Jordan/Jordan.htm**
8. **"PSD issues weather instructions," Jordan News Agency (PETRA), http: //www.petra.gov.jo/Public_News/Nws_NewsDetails.aspx?Site_Id=1&lang=2&NewsID=148352&CatID=13&Type=Home&GType=1**

Sampling data were obtained from the:

9. **Defense Occupational and Environmental Health Readiness System (referred to as the DOEHRS-EH & IH databases) at https: //doehrs-ih.csd.disa.mil/Doehrs/. Some of the data may be classified or otherwise have some restricted distribution. See discussion below.**
10. **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.**
11. **Abed, AM; Al Kuisi, M; and Kair, HA; "Characterization of the Khamaseen (spring) dust in Jordan," *Atmospheric Environment*, 2009, Vol 43, p. 2863-2876.**
12. **Abu-Allaban, M; Hamasha, S; and Gertler, A; "Road Dust Resuspension in the Vicinity of Limestone Quarries in Jordan," *Journal of the Air & Waste Management Association*, 2006, Vol 56, p. 1440-1444.**

Additional environmental health reports/survey documents are from the:

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

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

14. **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.**
15. **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.**
16. **USACHPPM, Particulate Matter Factsheet No. 64-009-0708, 2008.**

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

17. **Centers for Disease Control and Prevention (CDC) Travelers' Health website (http: //wwwnc.cdc.gov/travel/destinations/traveler/none/Jordan), "Destinations" section, Jordan.**
18. **"Cutaneous Leishmaniasis in U.S. Military Personnel – Southwest/Central Asia, 2002-2003." *Morbidity and Mortality Weekly Report (MMWR)*, October 24, 2003 / 52(42);1009-1012. http: //www.cdc.gov/mmwr/preview/mmwrhtml/mm5242a1.htm**
19. **Hartzell JD, Peng SW, Wood-Morris RN, Sarmiento DM, Collen JF, Robben PM, et al. "Atypical Q fever in US soldiers." *Emerg. Infect. Dis.* 2007 Aug. Available from http: //wwwnc.cdc.gov/eid/article/13/8/07-0218.htm**
20. National Medical Intelligence Center, Defense Intelligence Report" Jordan: Environmental Health Risk Assessment & Infectious Disease Risk Assessment

The DOEHRS-EH database was queried to obtain the available sample data for air, soil, and drinking and nondrinking water sources at MSAB, Jordan. 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 Deputy Assistant Secretary of Defense for Health Readiness Policy and Oversight (HRP&O).

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

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

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

DoD Health Readiness Policy and Oversight (HRP&O) Phone: (800) 497-6261. http: //fhpr.dhhq.health.mil/home.aspx