Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Muwaffaq Salti Air Base, Jordan
Calendar Years: 2013 - 2014

AUTHORITY: This Periodic Occupational and Environmental Monitoring Summary (POEMS) has been developed in accordance with Department of Defense (DoD) Instructions 6490.03, 6055.05, and JCSM (MCM) 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. It includes MSAB where 1200 U.S. personnel lived and worked. 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 30 June 2013 through 30 July 2014 to include deployment OEHS sampling and monitoring data (e.g. air, water, and soil), field investigation and health assessment reports, as well as country and area-specific information on endemic diseases.

This assessment assumes that 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 30 June 2013 through 30 July 2014.

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.

SITE DESCRIPTION:

Most of the country of Jordan (80%) is arid or semi-arid, with a desert plateau to the west and a high plateau in the east. MSAB is located in the eastern desert region of Jordan. This area of desert and desert steppe is part of what is known as the North Arab Desert. It stretches into Syria, Iraq and Saudi Arabia, with elevations varying between 600 and 900 meters above sea level.

Local Climate: Jordan is on the eastern margins of the Mediterranean climatic zone of the eastern Mediterranean. This climate is characterized by hot, dry summers and cool, wet winters. More than 90 percent of the country receives less than 200 mm annual precipitation. There is a maximum

annual rainfall of 600 mm in the north-west corner of the country. Average temperatures show a reverse pattern: they increase rapidly from the dissected plateaus to the very low level graben, increase gradually from the dissected plateau to the eastern margins of the eastern desert, and decrease gradually from north to south in line with increasing altitude. The highest annual and monthly values for evapotranspiration are in the desert with an annual total of 2,427 mm for Ma´an and 2,325 mm for Rweishid in the northeast. In the highlands, values vary from 1,485 mm at Rabba to 1,343 mm at Shoubak. Highest monthly precipitation values occur in July and the lowest in January for all the country.

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.

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

Short-Term Health Risks & Medical Implications:

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

Air Quality: For particulate matter less than 10 micrometers in diameter (PM10) and for PM less than 2.5 micrometers in diameter, i.e., PM2.5, the data was insufficient to characterize short-term risk. However, exposures may result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel while at this site, particularly exposures to high levels of dust such as during high winds or dust storms. For PM10 and PM2.5, certain subgroups of the deployed forces (e.g., those with pre-existing asthma/cardio-pulmonary conditions) are at greatest risk of developing notable health effects. Although most effects from exposure to particulate matter should have resolved post-deployment, providers should be prepared to consider the relationship between deployment exposures and current complaints. Some individuals may have sought treatment for acute respiratory irritation during their time at MSAB. Personnel who reported with symptoms or required treatment while at this site should have exposure and treatment noted in medical record (e.g., electronic medical record and/or on a Standard Form (SF) 600 (Chronological Record of Medical Care).

Food/Waterborne Diseases (e.g., bacterial and protozoal diarrhea, hepatitis A, typhoid fever, diarrhea-protozoal): 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.

Other Endemic Diseases (e.g., cutaneous leishmaniasis, sandfly fever, rickettsioses leptospirosis, schistosomiasis, Q fever): Vector-borne endemic diseases (cutaneous leishmaniasis, sandfly fever and rickettsioses). These diseases may constitute a moderate risk due to exposure to biting vectors; risk reduced to low by proper wear of permethrin-treated uniform and bed-nets in conjunction with the application of DEET repellent to exposed skin. Water contact diseases (leptospirosis, schistosomiasis) activities involving extensive contact with surface water may increase risk. Animal contact diseases (Q fever), pose year-round risk. Animal contact disease risks are mitigated by briefing personnel on CENTCOM General Order 1.C as well as informing personnel of health implications and avoidance techniques.

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

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: Although fine particulate matter less than 10 micrometers in diameter (PM_{10}) was not evaluated for long-term risk due to no available health guidelines, and data were insufficient to characterize long-term health risk from particulate matter 2.5 micrometers in diameter ($PM_{2.5}$), the area was a dusty desert environment. For inhalational exposure to high levels of dust, PM_{10}, and $PM_{2.5}$, such as during high winds or dust storms, it is considered possible that some otherwise healthy personnel who were exposed for a long-term period to dust and particulate matter could develop certain health conditions (e.g., reduced lung function, cardiopulmonary disease). Personnel with a history of asthma or cardiopulmonary disease could potentially be more likely to develop such chronic health conditions. While the dust and particulate matter exposures were acknowledged, at this time there were no specific recommended, post-deployment medical surveillance evaluations or treatments. Providers should still consider overall individual health status (e.g., any underlying conditions/susceptibilities) and any potential unique individual exposures (such as occupational or specific personal dosimeter data) when assessing individual concerns. Certain individuals may need to be followed/evaluated for specific occupational exposures/injuries (e.g., annual audiograms as part of the medical surveillance for those enrolled in the Hearing Conservation Program; and personnel covered by Respiratory Protection Program and/or Hazardous Waste/Emergency Responders Medical Surveillance).

Leishmaniasis-Visceral Infection: Leishmaniasis is transmitted by sand flies. Visceral leishmaniasis (a more latent form of the disease) causes a severe febrile illness, which typically requires hospitalization with convalescence over 7 days. The leishmaniasis parasites may survive for years in infected individuals. Consequently, this infection may go unrecognized until infections become symptomatic years later.

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** (as per risk assessment of the data). Daily levels vary, acute health effects (e.g., upper respiratory tract irritation) more pronounced during peak days. More serious effects are possible in susceptible persons (e.g., those with asthma/existing respiratory diseases).	Most personnel lived and worked in air conditioned buildings or tents. For those not working in air condition spaces, time outdoors was minimized and tent flaps kept closed.	Short-term: 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: The health risk associated with typical $PM_{2.5}$ exposures was **moderate**. The majority of the time no acute health effects such as eye, nose, or throat irritation from exposure was anticipated to have occurred. Mild acute (short-term) health effects were possible for those individuals who spent much of their time outdoors. Existing medical conditions (e.g., asthma or respiratory diseases) may be exacerbated.	Strenuous physical activities were limited when air quality was poor. Time was minimized outdoors, and windows and tent flaps were kept 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: From June 2013 – July 2014, the health risk associated with typical $PM_{2.5}$ exposures was **moderate**. During periods of low risk, no anticipated chronic health effects from $PM_{2.5}$ were anticipated to have occurred. At the moderate risk level, 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.

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]**
Airborne Metals	**None identified**	Burn barrel located downwind of occupied areas of the base.	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)	Short-term: Low	Burn barrel located downwind of occupied areas of the base. Fuel spills cleaned up quickly when they occur.	Short-term: **Low**
	Long-term: Low		Long-term: **Low**
Soil			
Soil	**None evaluated** at the base. Even when data is available, currently soil sampling data not evaluated for short term (acute) health risks**.**	Fuel spills cleaned up quickly if they occur.	**None evaluated**
Water			
Consumed Water (Water Used for Drinking)	Short-term: **Low** - U.S. Army Veterinarian approved bottled water.	U.S. Army Veterinary Command approved bottled water. Active and ongoing drinking water surveillance program.	Short-term: **Low**
	Long-term: **Low** - U.S. Army Veterinarian approved bottled water.		Long-term: **Low**
Water used for other purposes (non-drinking)	Short-term: **Low** – Radium - 226/228 levels above MEG of 5 pCi/L. However, since the water is not used for consumption, there is effect on health. This is naturally occurring radiation within the ground water.	Water surveillance programs which routinely monitor for disinfectant residual, bacteriological contamination, radionuclides, metals, and other constituents.	Short-term: **Low** - Based on the limited potential for ingestion of untreated water.
	Long-term: **Low** – Radium - 226/228 levels above MEG of 5 pCi/L. However, since the water is not used for consumption, there is effect on health.		Long-term: **Low**
Military Unique			
Chemical Biological, Radiological Nuclear (CBRN) Weapons	**None identified**	N/A	None identified
Depleted Uranium (DU)	**None identified**	N/A	None identified
Ionizing Radiation	None identified	N/A	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]**
Non-ionizing Radiation	Short-term: Low	Positioned antennas so they are only accessible to trained individuals.	Short-term: **Low**
	Long-term: Low		Long-term: **Low**
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 data bases e.g, TMDS, MERS, DRSi.		
Gastrointestinal (same as Food borne/Waterborne (e.g., diarrhea-bacteriological)	Short-term: **High**. If ingesting unapproved local food/water, the health effects can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (hepatitis A, typhoid fever, brucellosis, hepatitis E). Viral gastroenteritis can present due to a high rate of personnel turnover and shared dining, berthing, bathroom facilities, and working spaces.	Standard Preventive Medicine Measures: immunizations (Hepatitis A and typhoid fever), the consumption of food and water from approved sources, and habitability inspections to ensure cleanliness/sanitation.	Short-term: **Low**. Based on disease incident reporting from Jordan and DNBI data from MSAB.
	Long-term: **Low** since the majority of gastrointestinal diseases do not cause prolonged illness.		Long-term: **Low** based on disease incident reporting from Jordan.
Arthropod Vector Borne	Short-term: **Low**. Competent vectors (in very low numbers) and reservoirs for diseases are present for sandfly fever, Leishmaniasis, West Nile fever, rickettsioses, sindbis, Crimean-Congo haemorrhagic fever, malaria and plague.	Standard Preventive Medicine Measures: proper wearing of insecticide-treated uniforms and the application of insect repellent to the skin, chemoprophylaxis in accordance with COCOM policy (i.e., malaria), removal of vector harborages within camps, and the application of pesticides.	Short-term: **Low** to none for all vector-borne diseases based on disease incident reporting from Jordan.
	Long-term: **Low.** It is possible to be infected during deployment with leishmaniasis, 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: **Low** based on disease incident reporting from Jordan.		Long-term: **Low** based on disease incident reporting from Jordan.
Respiratory	Short-term: **Low**. The high rate of personnel turnover, shared dining, berthing, recreational facilities, and working spaces may allow for the easy transmission of upper respiratory infections, including influenza.	Influenza immunizations are given either before or during deployment. Local and third country national workers/contractors are required to	Short-term: **Low** for upper respiratory infections and tuberculosis.

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]**
	Long-term: **Low** The majority of respiratory diseases do not cause prolonged illness.	complete health screening prior to employment. Potential tuberculosis exposure is addressed in the Post Deployment Health Assessment.	Long-term: **Low** based on disease incident reporting from Jordan.
Animal Contact	Short-term: **Low** based on disease incident reporting from Jordan and vectors sighted at MSAB through vector surveillance program.	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** based on disease incident reporting from Jordan.
	Long-term: **Low** based on disease incident reporting from Jordan.		Long-term: **Low** based on disease incident reporting from Jordan.
Venomous Animal/ Insects			
Snakes, scorpions, and spiders	Short-term: **Low** - If encountered, effects of venom vary with species from mild localized swelling (e.g. scorpion species e.g *Scorpiops lindbergi*)) to potentially lethal (e.g. saw-scaled viper or *Gloydius halys*). Based on disease incident reporting from Jordan.	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: **No long-term health risk identified**		Long-term: **No long-term health risk identified**
Heat/Cold Stress			
Heat	Short-term: **Moderate** risk of heat injury in summer months for un-acclimatized personnel.	Adequate periods of acclimatization for newly reporting or returning personnel. Adjustment of work-rest cycles based on monitoring of climatic conditions.	Short-term: **Low**
	Long-term: **Low**		Long-term: **Low**
Cold	Short-term: **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. January is the coolest month with temperature reaching the low 40Fs.	Provision of adequate foul weather clothing Appropriate work/rest cycles during cold weather	Short-term: **Low**
	Long-term: **Low**		Long-term: **Low**
Noise			
Noise	Short-term: **Low** based on available data	Use of hearing protection.	Short-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]**
(Continuous) (Flightline, Power Production)	Long-term: **Low** based on available data	Labeling noise hazardous areas. Leadership enforcement of compliance with available Personal Protective Equipment (PPE).	Long-Term: **Low**
Impulse	Short-term: **Low**		Short-term: **Low**
	Long-term: **Low**		Long-term: **Low**
Unique Concerns			
Any incident of fire or spill that may have happened	**None identified**	N/A	**None identified**
Waste Sites/Waste Disposal	**None identified**	Regular trash is removed by a local contracted agency.	**None identified**
Fuel/petroleum products/ industrial chemical spills	Short-term: **Low** based on available data	Cleanup spills as soon as possible while wearing appropriate personal protective equipment	Short-term: **Low**
	Long-term: **Low**		Long-term: **Low**
Pesticides/Pest Control	**None identified**	See Section 10.4	**None identified**
Asbestos	Short-term: **Low**	Manage in place	Short-term: **Low**
	Long-term: **Low**		Long-term: **Low**
Leaded Paint	**None identified**	N/A	**None identified**
Burn Pits	**None identified**	N/A	**None identified**

POEMS

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 30 June 2013 through 30 July 2014. 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.

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.

a. MSAB's hot, dry climate results in very dusty conditions throughout the year. During the spring each year, Jordan is affected with Khamaseen dust cyclones from the North African Sahara. The days of notable sandstorms at MSAB were 3 Mar 14, 30 Mar 14, 1 Apr 14, 20 Apr 14 and 7 May 14. Due to the limited visibility of the dust storm on 20 April 14, Jordan's Public Security Department (PSD) issued precautions to motorists driving on desert roads. 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.

b. In Jordan's major cities of Amman and Zarqa, the sources that contribute significantly to air pollution were motor vehicles, oil refineries, open burning, mining, and quarries. There was a small village about two miles away from MSAB. There were no industrial sources present in the immediate vicinity of the MSAB. However, onsite electric power generation by numerous tactical generators located throughout the air base may have contributed air pollutants such as nitrogen oxide, carbon monoxide, hydrocarbons and particulate. Exhaust products associated with diesel/JP-8 fuel for electric power generation does occur. A burn barrel (Jul 2013 to present) was used to dispose of classified paper documents approximately three to five times per week. Regular trash was removed by a local contracted agency.

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

2.2 Particulate Matter

Particulate matter (PM) is a complex mixture of extremely small particles suspended in the air. PM includes solid particles and liquid droplets emitted directly into the air by sources such as: power plants, motor vehicles, aircraft, tactical generators, construction activities, fires, and natural windblown dust. PM can include sand, soil, metals, volatile organic compounds, allergens, and other compounds such as nitrates or sulfates that are formed by condensation or transformation of combustion exhaust. PM

composition and particle size vary considerably depending on the source. Generally particulate matter of health concern is divided into two fractions: PM_{10}, which includes coarse particles with a diameter of 10 micrometers or less (0.0004 inches or one-seventh the width of a human hair), and fine particles less than 2.5 micron ($PM_{2.5}$), which can reach the deepest regions of the lungs when inhaled. Exposure to excessive PM is linked to a variety of potential health effects.

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

2.3.1 Exposure Guidelines:

Short-term (24-hour) PM_{10} (mg/m^3):
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 September 2013. No PM_{10} air sampling was available for 2014. 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. No PM_{10} samples were collected at any other DoD site within Jordan from 2013-2014 based on the available data in DoD databases. 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.

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. Overall 1/2 (50%) of the samples were between the 24-hour negligible MEG and the 24-hour marginal MEG. In this particular case, the data were insufficient to characterize health risk associated with PM10 exposure with statistical confidence. Based on the two samples, the acute health risk is presumed to be low.

Risk Summary: **Low** (for a peak exposure day)

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 and inconsistency of sampling. 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.

Return to Table 2

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 September 2013 to April 2014, three ambient air $PM_{2.5}$ samples were collected at MSAB for $PM_{2.5.}$ From August 2013 to April 2014, eight ambient air $PM_{2.5}$ samples were collected at the Patriot Missile site. Since this site was about one-to-two miles away from MSAB, the ambient air data was combined for analysis. The range of 24-hour $PM_{2.5}$ concentrations was 0.0098 mg/m^3 – 0.451 mg/m^3 with an average concentration of 0.118 mg/m^3. The geometric mean was 0.062 mg/m^3. The geometric standard deviation (GSD) was 3.4. Vehicle movement at the Patriot Missile site was noted to re-suspend dust.

For comparison, nine samples were collected from the Joint Training Camp in Zarqa, Jordan from March 2013 to December 2013, which was approximately 50 miles away. The range of 24-hour $PM_{2.5}$ concentrations was 0.008 mg/m^3 – 0.027 mg/m^3 with an average concentration of 0.022 mg/m^3. Six samples were collected from the in King Abdullah II Special Operations Training Center, (KASOTC) in Amman, Jordan from August 2013 to April 2014. The range of 24-hour $PM_{2.5}$ concentrations was 0.007 mg/m^3 – 0.061 mg/m^3 with an average concentration of 0.029 mg/m^3. One sample was collected at Prince Hussein Royal Airbase in August 2013, and the result was 0.026 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. The three highest sample results at MSAB were 0.451 mg/m^3 (4-5 October 2013), 0.322 mg/m^3 (11-12 December 2013), and 0.156 mg/m^3 (11-12 December). Overall 2/11 (18%) of the samples were between the 24-hour marginal MEG and the 24-hour critical MEG.

Risk Summary: Moderate (for a peak exposure day)

Medical implications: At a moderate risk level, 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 resolve when exposure ceased. A small number of individuals may experience more pronounced effects such as decreased lung function and worsening of pre-existing medical conditions such as asthma.

Confidence in the risk assessment: Confidence in the risk assessment is **low** based on the limited $PM_{2.5}$ air sampling data available, inconsistency of sampling intervals, and variability in the weather. Since dust storms are known to occur in Jordan and around MSAB, the sampling results may not reflect the most acute risk.

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

Approach: For chronic health risk, it was assumed that a deployment lasted twelve months. To assess chronic risk associated with $PM_{2.5}$, the overall yearly average measured concentration of $PM_{2.5}$ was used to arrive at a long term health risk. The average concentration of 0.118 mg/m^3 was greater than the long-term 1-year marginal MEG of 0.065 mg/m^3. However, the geometric mean was 0.062 mg/m^3, which was slightly under the marginal MEG. The geometric mean was less influenced by the extreme values in the data set, but in this case the data set was small. Overall 5/11 (45%) of the samples were above the 24-hour marginal MEG.

Risk Summary: Moderate (for a typical exposure day)

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, as the majority of the population at MSAB typically does not work outdoors for more than eight to twelve hours/day, the risk for these chronic conditions is likely overstated.

Confidence in the risk assessment: Confidence in the risk assessment is **low** based on the limited $PM_{2.5}$ air sampling data available, inconsistency of sampling intervals, and variability of the weather. The samples were not taken set intervals throughout the year. There were three samples collected in October 2013, and three samples collected in December 2013.

Return to Table 2

2.5 Airborne Metals

2.5.1 Sample Data/Notes:

From 2013 through 2014, metals analysis was performed on five 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) published in the USAPHC TG 230. No metals were detected above the limit of quantification (LOQ).

The Patriot Missile Site, which was one-to-two miles away from MSAB had eight ambient air samples from August 2013 to April 2014 collected for metals. None of these samples had results above the MEGs. One sample had a detection of manganese, but it was below the MEGs. Based on research in the published scientific literature, manganese oxide was a constituent of Khamaseen dust that was collected near Azraq, Jordan and analyzed by the University of Jordan.

Risk Summary: Low--No metals were detected either above the 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 nearly causing the release of these metals.

Return to Table 2

2.6 Volatile Organic Compounds (VOC)

2.6.1 Sample Data/Notes:

From the 17-20 September 2013, six valid air samples were collected at MSAB for VOC analysis. Only one air sample had a result above a MEG. Specifically, methylene chloride was measured at 1.064 mg/m3, which was above 1-year negligible MEG of 0.71 mg/m3. All the other VOC results were below the MEGs.

Approach: Typically, most VOC sampling is either associated with a specific source or incident driven. Data of this type, especially when there is sparse sampling data exist, is generally not representative of exposure to an entire base population. For screening purposes, peak and average concentrations of all airborne VOCs detected were compared to their corresponding 1-year negligible MEG. Short-term risk estimates based on the USAPHC TG 230 methodology are determined for any compound detected at a concentration greater than its 1-year MEG and long-term risk estimates were determined where VOC were detected above their respective 1-year MEG in 5% or more of the samples collected.

Risk Summary: **Low**

The risk level was based on the limited VOC air sampling data available and inconsistency of sampling. However, 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. The overwhelming majority of others will have far less potential for exposure at the measured levels.

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

For personnel with potential for exposure based on the levels detected, no short-term health risk was identified. The sampled concentrations of VOCs 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. The overwhelming majority of others will have far less potential for exposure at the measured levels. The principal route of human exposure to methylene chloride is inhalation of ambient air.

Medical Implications: None expected at the concentration measured. Methylene chloride can irritate the eyes, nose, and throat. Acute inhalation exposure to high levels of methylene chloride in humans have resulted in effects on the central nervous system (CNS) including decreased visual, auditory, and psychomotor functions, but these effects are reversible once exposure ceases.

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

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

Approach:
For screening purposes, sample results for each detected VOCs were compared with each of the corresponding yearly (long-term) MEG for each respective VOCs published in the USAPHC TG 230.

Risk Summary: Low – The long-term health risk is low because there is a lack of a regular known source of exposure.

Medical Implications
Chronic effects would not be expected since there was no information to suggest that VOC exposures over the MEGs was a regular event. The major effects from chronic inhalation exposure to methylene chloride in humans are effects on the CNS, such as headaches, dizziness, nausea, and memory loss. Animal studies indicate that the inhalation of methylene chloride causes effects on the liver, kidney, CNS, and cardiovascular system. 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. The overwhelming majority of others will have far less potential for exposure at the measured levels.

Confidence in risk estimate: Confidence in the risk assessment is **low** based on only six samples collected MSAB. However, there was also no qualitative information to suggest that VOC exposure over the MEGs was a regular event.

Return to Table 2

3 Soil

3.1 Site-Specific Sources Identified

3.1.2 Sample Data/Notes*:*

No soil data was collected and analyzed for MSAB. Samples were collected at other locations within Jordan, which may not be representative of MSAB due to different conditions and geology.

For comparison, the chemicals detected in the August 2013 soil samples from three locations in Jordan (i.e., Joint Training Camp, King Abdullah II Special Operations Training Center, and Prince Hussein Royal Air Base) were not identified as potential hazards because the concentrations were not greater than USAPHC TG 230 MEGs. At the Patriot Missile site in Jordan, a soil sample collected from a motor pool/hazardous material area detected 2-Nitrophenol above the 1-year MEG. Although personnel might remain at the Patriot Missile Site for approximately one year, most personnel will not be exposed to the soil in the motor pool and hazardous materials area and those that are will not be working in that area continuously for one year. Additionally, 2-Nitrophenol is biodegradable in soil in approximately 64 days, so it may not be present in the soil the entire year. Therefore, exposure to 2-Nitrophenol in the soil would not be expected to be a long-term health concern.

The primary exposure pathways associated with soil are dermal contact and incidental ingestion. Individuals involved in construction, maintenance and post fire clean-up activities were at greatest potential for exposure to soil. These individuals comprise a relatively small proportion of the overall base population. The primary exposure pathways associated with soil are dermal contact and incidental ingestion.

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

Approach: Currently, if there were sampling data for soil, it would not be evaluated for short-term (acute) health risks**.** For long-term health risk, sample results would be compared with each of the corresponding long-term MEGs published in the USAPHC TG 230 screening purposes. Compounds detected without a single exceedance of the 1-year MEG were excluded from further consideration. Long-term risk estimates were based on the probability of exposure to the concentrations detected.

3.1.3 Short-term (acute) health risk for soil:

Risk Summary: Not evaluated as no health guidelines associated with short-term exposures to soil have been established.

Confidence in the Risk Assessment: **Not applicable**, soil is not evaluated for short-term health risks**.**

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

Long-Term: Indeterminate based on no quantitative data or qualitative information

Risk Summary: Based on available data, **no long-term health risk** was identified for any base population.

Confidence in risk estimate: Confidence in the risk assessment is **low** since no samples were collected at MSAB. However, the dermal exposure pathway is only a risk for rare non-routine tasks based on the typical activities at MSAB.

Return to Table 2

4 Water

4.1 Site-Specific Sources Identified

Historically, commercial bottled water was provided for drinking at MSAB. Three venders were available to provide bottled water and were approved by VETCOM. Coca Cola and Pepsi (aka Nestle) are local to Jordan. All drinking water for MSAB comes from the same source (i.e., Coca Cola) under the brand name of Arwa. Pepsi was also approved but not used. The bottled water (under the vendor Anham) for cooking comes from Kuwait with the food shipments.

The water provided for non-drinking use comes from the Jordanian aquifer. Municipal water from onsite wells was supplied for non-drinking purposes at MSAB. There is a treatment facility for the water, but there is uncertainty as to whether it is operational. Around 1 April 2014, the municipal water was designated to be used only for personal hygiene such as hand washing, showering, laundry, cleaning, and washing dishes. Prior to 1 April 2014, the municipal water through a faucet was used for food preparation and a disinfectant was used for vegetable washing. No Reverse Osmosis (RO) units were installed at MSAB.

4.2 Consumed Water (Water for drinking or cooking consumption)

4.2.1 Sample Data/notes:

From June 2013 through July 2014, 509 bottled water samples from 97 lots were collected at MSAB and analyzed on-site using the Colilert testing method. The Colilert tests specifically for presence or absence of Total Coliforms and *E. coli*. Five of the samples from the same lot have tested presumptive positive during an incident from 10-13 March 2014 (i.e., three water bottles tested presumptive positive,

and two samples were repeated with different Colilert media). The Coca-Cola (Jordan) Quality Assurance Manager started an investigation when he learned of the results. He concluded that his investigation results showed a variable ozone concentration at finished water tank before the filler at the startup of the 18 February 2014 production. This isolated incident was resolved. All subsequent samples from bottled water have tested negative with the Colilert test.

Personnel at MSAB have not sent any bottled water to a laboratory for analysis. Therefore, there is no data available to compare any potential contaminants to the MEGs.

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

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

- MSAB residents ingest 15 liters of bottled water per day or less.
- For risk assessment purposes, all U.S. personnel at this location were assumed to remain at this site for approximately 1 year. Actually, deployments for personnel vary by service (Army personnel spent 12 months on-site, AF personnel six months and the Navy/Marines are typically short term or transient in nature).
- Lots of bottled water are tested using the Colilert method twice/week.

When testing reveals total coliforms but no *E. coli*, an immediate response is taken to address the situation. However, it is not an immediate health risk as with the detection of *E. coli.* In other words, the presence of total coliforms does not necessarily represent potential pathogen contamination to the extent that the presence of *E. coli* does. This substandard result indicates that untreated water may be getting into the production process or through a defective treatment process. As long total coliforms are detected, there is risk of fecal contamination. Coliforms are not uniformly distributed in water and are subject to considerable variation. Coliform or other bacteria in drinking water will not necessarily make a person ill. However, since these organisms are present, other disease-causing organisms may also be present.

Risk Summary: Based on the above approach, the short-term risk associated with consumption of bottled water at MSAB is **low**. All subsequent samples from the March 2014 incident have tested negative with the Colilert test. The water bottle company resolved the treatment issue that caused the original incident.

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, since these organisms are present, other disease-causing organisms may also be present. Two common waterborne diseases are giardiasis and cryptosporidiosis; both cause intestinal illness. *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 frequent Colilert testing of the lots to catch any issues as soon as possible. Also, US Army veterinary personnel performed regular audits of all bottled water suppliers to ensure consistency of quality.

Return to Table 2

4.3 Water for Non-Drinking/Other purposes

4.3.1 Sample Data/notes:

From June 2013 through July 2014, 71 municipal water samples were collected at MSAB for analysis by the Colilert method. There were 26 samples from these non-potable sources that tested positive for total coliform. The positive samples were from all over MSAB and did tend to happen in clusters during the same day. None of the positive results from the non-potable sources ever occurred singularly. The Total coliform in the water suggested as one possibility that surface water might have gotten into the well or that a bacterial growth developed within the well or plumbing system.

Preventive medicine surveillance for microbiological contaminants (i.e., coliforms/*E.coli*) is standard operating procedure, but data associated with bacteriological analyses was not available. As of the time of development of this document, the Patriot Missile Site which was within 1-2 miles of MSAB did not have any available water sampling results in Joint DoD databases to compare results with MSAB.

On 24 January 2014, three municipal water samples were analyzed for inorganic compounds and various physical characteristics. Total dissolved solids (TDS) and gross alpha activity did not meet the DA TB MED 577 military long-term potability standards. Similar results also were obtained from a latrine sample in January 2014. The three municipal water samples averaged 26 picocuries per liter (pCi/L) of gross alpha activity and 14 pCi/L for gross beta activity which exceeds the DA TB MED 577 military long-term potability standards of 15 pCi/L for gross alpha activity and gross beta activity is limited to 4 millirem per year. At that time the water source for food preparation was switched from the Jordanian aquifer to bottled water imported from an approved source in Kuwait. In April 2014, additional water samples were taken to better characterize the types of radionuclides involved. These samples determined that the radium 226 concentration (13 pCi/L) did not meet the DA TB MED 577 military long-term potability standard for combined radium 226 and radium 228 (i.e., 5 pCi/L). Radionuclides are forms of elements that emit radiation (e.g., alpha and beta particles). Most radionuclides are naturally occurring, but some come from man-made sources.

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 for at least four months, and well water was used for personal hygiene purposes.
- Deployments for personnel vary by service (i.e., Army personnel spent 12 months on-site, AF personnel six months and the Navy/Marines are typically short term or transient in nature).
- The primary routes of exposure associated with the municipal water were incidental ingestion through cooking and personal hygiene (i.e., brushing teeth/oral hygiene) and dermal contact when showering.
- MSAB residents ingest far less than two liters (during food preparation or personal hygiene) of municipal 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** – The risk was low since the municipal water would not be used for food preparation. There were no known illnesses linked to the municipal water supply when it was used for food preparation. If an individual annually consumed two liters per day of the untreated water it would result in an annual radiation dose of approximately 80 millirems. The concentrations of alpha and beta activity would not be expected to cause a health effect based on the expected nonpotable uses of the water.

Medical Implications: Short term effects of high levels of exposure of radionuclides include changes in blood chemistry, nausea, fatigue, vomiting, hair loss, and diarrhea. Prolonged exposure to high doses of these types of radiation is known to cause cancer in humans and cause genetic defects in the children of exposed parents.

Confidence in the Risk Assessment: **High** - Confidence in the risk assessment is high since bottled water started to be used for food preparation and limited potential for ingestion. If municipal water had continued to be used for food preparation, additional sampling would have had to be conducted to have high confidence in the risk due to the uncertainty of when *coliform/E coli* would be detected.

Return to Table 2

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 June 2013 to July 2014 time frame. In 2014, Syria delivered to Western governments the last stockpiles of Syria's declared chemical weapons.

5.2 Depleted Uranium (DU)

There were no specific hazard sources or exposure incidents documented in DOEHRS or the MESL during the period from June 2013 through July 2014 time frame.

5.3 Ionizing Radiation

No specific hazard sources were documented in DOEHRS or the MESL from the June 2013 through July 2014 time frame. The Nondestructive Inspection (NDI) shop performed all nondestructive testing and identification of potential stress areas on aircraft equipment and parts, but the NDI shop did not perform x-ray inspections.

5.3.1 Short and long-term health risks: Low based on available information.

Medical implications: No health effects are anticipated since there are no known sources of ionizing radiation.

Confidence in the Risk Assessment: High - No information was available to suggest an ionizing radiation source exists at MSAB.

5.4 Non-Ionizing Radiation

MSAB has various sources of non-ionizing radiation such as antennas.

5.4.1 Short and long-term health risks: Low based on available information. The parameters of the antennas have been reviewed, and a hazard distance has been calculated for them.

Medical implications:
Exposure to very high non-ionizing 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.

Confidence in the Risk Assessment: **High**. Assessments of the hazard distances for the various antennas have been conducted. The hazard distances range from five feet to near zero feet away from the antennas. Due to the locations and small hazard distances, the risk of over-exposure is low.

Return to 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.

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 for 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 for viral gastroenteritis was **low** due to a high rate of personnel turnover, shared dining, berthing, bathroom facilities, and working spaces was not substantially different than that expected in similar settings within the United States.

The short-term risk associated with food borne and waterborne diseases in Jordan was low (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 may require greater than 72 hours convalescence and/or hospitalization.

Confidence in the risk assessment: Confidence in the risk assessment is 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: The long-term risk associated with food and waterborne diseases was **low** for protozoal diarrhea and brucellosis.

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

Confidence in the risk assessment: Confidence in the risk assessment is **moderate**. Incidence of protozoal diarrhea and brucellosis in the post deployment military population is known to be extremely low.
Return to Table 2

6.3 Arthropod Vector-Borne Diseases

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

Approach: The health risk for endemic vector-borne diseases to individuals deployed to 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:

The short-term risk for the vector-borne diseases sandfly fever, West Nile Fever, Crimean-Congo hemorrhagic fever, typhus, and plague was **low**. Individuals who deploy from MSAB, and/or supported base camps, to urban or rural outlying areas may experience increased short-term risk.

The short-term risk for malaria and cutaneous leishmaniasis was **low.** Individuals who deployed from MSAB or the other camps in the immediate vicinity, to urban or rural outlying areas, may have experienced increased short-term risk.

Medical implications:

Sandfly fever, West Nile Fever, Crimean-Congo hemorrhagic fever, 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.

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

Confidence in the risk assessment: Confidence in the risk assessment is **moderate**. Reports of vector borne disease, including malaria and leishmaniasis, were received through official DoD medical event reporting systems.

6.3.2 Long-term (chronic) health risks:

Risk assessment:

The long-term risk for arthropod vector-borne diseases is **low.**

Medical implications:

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

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

Return to Table 2

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 was **low**.

Medical implications: Leptospirosis, which has an incubation period of 5-14 days, presents as acute fever with nonspecific symptoms that last for 1 week to several months.

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

Return to Table 2

6.5 Respiratory Diseases

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

Approach: The health risk for respiratory diseases to individuals deployed to 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.

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

Medical implications:

Upper respiratory infections, particularly from viral agents, can cause periodic outbreaks in spite of preventive measures. A small proportion of infections may require greater than 72 hours convalescence and/or hospitalization.

Symptoms of tuberculosis, including fever, weight loss, night sweats and cough, typically start within 1-6 months of infection. The lifetime risk for tuberculosis after becoming infected is 5-10%; half of this risk occurs in the first two years following infection.

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

Return to Table 2

6.6 Animal-Contact Diseases

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

Approach: The health risk for endemic animal contact diseases to individuals deployed to 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), 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.

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

6.6.2 Long-term (chronic) health risks:

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

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: Confidence in risk assessment is **high.**
Return to Table 2

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. Health risk was **low**.

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 envenomations may result in numbness, frothing at mouth, difficulty breathing, and convulsions. Various factors influence the severity of the envenomation to include health and age of patient, sting site, and size and age of scorpion. Most scorpion venom is neurotoxic with a mixture of other substances. If the patient is allergic to bee and wasp stings, extreme caution and care must be taken to prevent excessive morbidity and even possibly death. The following three scorpions are listed as present in 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. Antivenin available in Amman.

- *Androctonus crassicudauda (*Arabain Fat-Tail). Some authorities report a sting from a Black Fattail Scorpion can kill an adult human in seven hours. Reactions vary considerably. Antivenin available in Amman.
- *Leiurus jordanensis (*Jordan's Black Deathstalker) venom is most powerful and most painful and can kill children and elderly people. Antivenin 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**.

7.5 Long-term (chronic) health risk:

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

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

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

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

Return to Table 2

8 Heat/Cold Stress

8.1 Site-Specific Conditions:

At MSAB, the average low and high in August was 65°F and 95°F. August was on average the hottest part of the summer. The average low and high in January was 35°F-54°F. January is on average the coldest month of the year. MSAB had less than one year of monitoring the weather. Thus far, the highest recorded temperature in June was 108°F, and the lowest was 25°F in January.

8.2 Heat

8.2.1 Heat Exposure Guidelines

The risk of heat injury is based on the Wet Bulb Globe Temperature Index as follows:
Low (80-84.9 °F)
Moderate (85-87.9°F)
High (88-89.9°F)
Extremely High (≥ 90°F)

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

Approach: No 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 strictly on existing climatologic data.

Risk Summary:

Short-term (acute) health risk: **Moderate** - The short-term health risk of heat injury for unacclimatized individuals (i.e. on site less than four weeks) from May-September was 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** - The long-term health risk was low**.**

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

Confidence in the risk assessment: Based on generally available information on climatic conditions and the absence of reported heat injuries, confidence in risk assessment is **high**. Individuals who experienced mild symptoms of heat injury may not have sought medical attention; this may lead to an underestimation of the risk.
Return to Table 2

8.3 Cold

8.3.1 Short (acute) and long-term (chronic) health risks*:* **Low** based on available information.

Approach: No cold injury 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 strictly on existing climatologic data.

Risk Summary: The risk for cold stress/injuries is largely dependent on clothing/equipment worn, operational work intensity and individual factors rather than environmental factors alone. The acute and chronic risk for non-freezing cold injuries, such as chilblain, trench foot, and hypothermia was low**.** The risk of cold stress/injury increases with colder temperatures, wind, longer exposures, inactivity, and inadequate clothing. The period of greatest risk of cold stress/injury is during January.

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.
Return to Table 2

9 Noise

9.1 Continuous

9.1.1 Exposure Guidelines:

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

9.1.2. Site Specific Conditions:

Sources of potential noise include flight line operations, associated with both fixed and rotary wing aircraft, tactical generators and various hand tools in maintenance shops. Due to the inherent noise hazard in flight line operations, personnel were required to wear dual hearing protection. The aerospace ground equipment (AGE) shop has several pieces of hazardous noise equipment. Their "Dash 60" generator was measured to be 109.7 dB(A).

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

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

Risk Summary:

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

Long-term health risk: The long-term risk of noise induced hearing loss with appropriate hearing protection use is **low**.

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

9.2 Impulse

No measured information from MSAB about potential sources of impulse noise (140 dbA) or greater was available. Impulse noise exposure is typically associated with the discharge of weapons. MSAB does have a firing range, which has a large berm made from sand to catch bullets.

9.2.1 Short-term (acute) and Long-term (chronic) health risks: Low – Personnel have been given hearing protection and training on the use of hearing protection. There is no information to suggest that the exposure to impulse noise at the firing range is any more than at home station.

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: Low since there is no documented information.

Return to Table 2

10 Unique Concerns

10.1 Asbestos and Lead-Based Paint

10.1 Site-Specific Conditions:

Roughly 85% of the population works in structures (mostly tents) constructed by the DoD. Approximately 15% work in hardened facilities constructed by Jordan. 100% of DoD personnel sleep in DoD constructed facilities. The structures are not painted, and there are only three hardened facilities on MSAB--one latrine, the dining facility and the headquarters building. There are no known issues of exposure to potential sources of asbestos containing material (ACM) or peeling paint that could contain lead. Two bulk samples were taken for analysis for asbestos, and the results were non-detect. No systematic base-wide survey has occurred. It is not uncommon for countries outside the U.S. to use materials that contain asbestos. Asbestos-containing materials that are intact and managed in place, present minimal hazards to US personnel.

10.1.1 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. Long-term exposure to lead in adults can cause decreased memory and concentration; weakness in fingers, wrists, or ankles; small increases in blood pressure, particularly in middle-aged and older people; and anemia.

Confidence in the Risk Assessment: **High** – Since the structures are not painted, the risk to lead based paint is non-existent. The qualitative and quantitative information available suggests that there is not an issue with lead based paint or asbestos.

10.2 Unique incidents at the site/Waste Disposal

No unique incidents are known to have occurred at the site. There have been no incidents of fire. Regular trash is removed by a local contracted agency. US personnel have little to no exposure to waste materials.

Return to Table 2

10.3 Potential Environmental Contamination Sources

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

10.2.1 Short-term (acute) and Long-term (chronic) health risks: **Low** based on available information.

Medical implications: The potential health effects would be dependent on the specific chemical that spilled. Possible health effects often depend on the way personnel were exposed (i.e., skin, oral, or breathing), the length of time of exposure, and personal characteristics (i.e., age, gender, genetic traits, diet, and other habits). Health effects of fuel may include irritation to unprotected skin, eye and upper respiratory irritation, fatigue, breathing difficulty, headaches, dizziness, and sleep disturbances. Scientific research on long-term effects is not conclusive. However, if an individual is exposed to large amounts of fuel for a long period of time, research shows there is a potential for health effects, such as lung and heart problems.

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 was not an integrated pest management plan during June 2013 to July 2014. MSAB did not have a local entomology specialist on site. The plan for the future was to have a pest management technician come to MSAB and train local Civil Engineering personnel. Pest Management personnel are not anticipated to be permanently assigned to MSAB. Pest Management duties have been divvied out largely by Public Health and Civil Engineering. The goal is to 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 and sanitation were first and primary efforts. Secondary measures included the use of targeted bait applications for flies and rodents, and various animal trapping methods.

Risk Summary: None - pesticides were not used.

Medical implications: No health effects were anticipated since pesticides were not used.

Confidence in the risk assessment: Confidence in the risk assessment is **high** since pesticides were not used. There is no information to suggest any issues with the pest management practices performed.

10.5 Burn Pit

MSAB did not have a burn pit from June 2013 to July 2014.

Return to Table 2

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 XXXcountry – 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. **World Health Organization (WHO) World Malaria Report 2012, page 141.**
19. **"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**
20. **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**

21. 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 the Deputy Assistant Secretary of Defense (DASD) for Force Health Protection and Readiness (FHP&R).

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

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

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

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