Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Lafarge Cement Factory, Syria
Calendar Years: (2016-2018)

AUTHORITY: This periodic occupational and environmental monitoring summary (POEMS) has been developed in accordance with Department of Defense (DoD) Instructions 6490.03, 6055.05, and JCSM (MCM) 0017-12 (References 1-3).

PURPOSE: This POEMS documents the Department of Defense (DoD) assessment of occupational and environmental health (OEH) risk for Lafarge Cement Factory (LCF), Syria. It presents a qualitative summary of health risks identified at this location and their potential medical implications. The report is based on information collected from 1 January 2016 through 31 December 2018 to include deployment OEHS sampling and monitoring data (e.g., air, water, and soil), field investigation and health assessment reports, as well as country and area-specific information on endemic diseases.

This assessment assumes that environmental sampling at LCF 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 1 January 2016 through 31 December 2018.

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

SITE DESCRIPTION:

LCF is an industrial site, and the previous site of the Lafarge Cement Factory before it closed. The base is surrounded by rural scrub desert. Most chemical hazards from the previous industrial production have been cleaned up or remediated, including silica which was a concern for a time. Most of the piles of silica have been removed, and the coal and soda ash piles are settled unless disturbed. Almost all roads are paved and there are living and working quarters present on base. Power is supplied by generators and there is a burn pit present as the main trash disposal (reference 1). Lafarge Cement factory was previously identified being near Kobane, Syria before it was shut down, however the exact coordinates for LCF are classified.

Personnel deployed to LCF are exposed to various airborne constituents. Windblown dust, industrial pollution, and sand contribute to airborne particulate matter (PM) exposures. There are a number of industrial activities including fuel storage and distribution, water and wastewater treatment, and concrete and asphalt production, located on and around LCF that may contribute to air contaminants such as dust, metals and chemical gases. Additional pollutants result from the Army's use of open burn pits to dispose of waste/refuse such as paper, plastic, and wood. A CBRN team identified stockpiles of chlorine, soda ash, charcoal and silica at LCF. Samples obtained from the site included locations such as fuel points, buildings, the area around the burn pit, living area and the area near the incinerator.

SUMMARY: Conditions that may pose a Moderate or greater health risk are summarized in Table 1. Table 2 provides population based risk estimates for identified OEH conditions at LCF. As indicated in the detailed sections that follow Table 2, controls established to reduce health risk were factored into this assessment. In some cases, e.g., ambient air, specific controls are noted, but not routinely available/feasible.

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

Short-term health risks & medical implications:

The following hazards may be associated with potential acute health effects in some personnel during deployment at Lafarge Cement Factory (LCF), Syria and vicinity:

For heat stress, risk can be greater during months of June through September, and greater for susceptible persons including those older than 45, of low fitness level, unacclimatized, or with underlying medical conditions, and those under operational constraints (equipment, PPE, vehicles). Risks from heat stress may have been reduced with preventive medicine controls, work-rest cycles, proper hydration and nutrition, and mitigation.

Air quality: For inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}) from environmental dust, the PM_{10} overall short-term health risk was 'Low.' For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) from environmental dust, the $PM_{2.5}$ overall short-term health risk was 'Low.' However, the LCF and vicinity area is a dust-prone desert environment, with a semi-arid climate, also subject to vehicle traffic. Consequently, exposures to PM_{10} and $PM_{2.5}$ may vary, as conditions may vary, and may result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel while at this site, particularly exposures to high levels of dust such as during high winds or dust storms. For PM_{10} and $PM_{2.5}$, certain subgroups of the deployed forces (e.g., those with pre-existing asthma/cardio-pulmonary conditions) are at greatest risk of developing notable health effects. A burn pit existed at LCF. Burn pits might also have existed in the vicinity (e.g., burn pits used by the local population); however, the PM_{10} and the $PM_{2.5}$ overall short-term health risks specifically for burn pits were not evaluated due insufficient environmental samples collected near burn pits provided for analysis– see Section 10.7. Where burn pits exist, exposures may vary, and exposures to high levels of PM_{10} and $PM_{2.5}$ from smoke may result in mild to more serious short-term health effects (e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups. Although most short-term health effects from exposure to particulate matter and incinerator and/or burn pit smoke 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 while at LCF and vicinity. Personnel who reported with symptoms or required treatment while at site(s) with burn pit activity 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*).

Long-term health risks & medical implications:

The following hazards may be associated with potential chronic health effects in some personnel during deployment at Lafarge Cement Factory (LCF), Syria and vicinity:

Air quality: For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) from environmental dust, the overall long-term health risk was 'High.' Inhalable coarse particulate matter less than 10 micrometers in diameter (PM_{10}) from environmental dust was not evaluated for long-term health risk due to insufficient data for analysis and no available health guidelines. However, the LCF and vicinity area is a dust-prone desert environment with a semi-arid climate, also subject to vehicle traffic, and conditions may have varied. A burn pit existed at LCF. Burn pits also might have existed in the vicinity (e.g., burn pits used by the local population); however, the PM_{10} and the $PM_{2.5}$ overall long-term health risks specifically for burn pits were not evaluated due to insufficient environmental samples collected near burn pits provided for analysis– see Section 10.7. Where burn pits exist, exposures may vary, as conditions may have varied. For inhalational exposure to high levels of dust containing PM_{10} and $PM_{2.5}$, such as during high winds or dust storms, and for exposures to incinerator and/or burn pit smoke, 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 and exposures to burn pits are 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 burn pits/barrels, incinerators, 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).

Table 2. Population-Based Health Risk Estimates - Base camp that includes LCF [1, 2]

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
AIR			
Particulate matter less than 10 micrometers in diameter (PM_{10})	Short-term: The health risk is Low. Daily levels vary, acute health effects are (e.g., upper respiratory tract irritation) more pronounced during days with elevated PM levels. More serious effects are possible in susceptible persons (e.g., those with asthma/pre-existing respiratory diseases).	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: The health risk is Low. Daily levels vary; acute health effects are (e.g., upper respiratory tract irritation) more pronounced during days with elevated PM levels. More serious effects are possible in susceptible persons (e.g., those with asthma/pre-existing respiratory diseases).
	Long-term: No health guidelines		Long-term: No health guidelines
Particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$)	Short-term: The health risk is Low. Daily levels vary; Because LCF Sryria is situated in a dusty semi-arid desert environment, a majority of the time mild acute (short term) health effects are anticipated. Elevated levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.	Limiting strenuous physical activities when air quality is especially poor; and taking actions such as closing tent flaps, windows, and doors.	Short-term: The health risk is Low. Daily levels vary; Because LCF Sryria is situated in a dusty semi-arid desert environment, a majority of the time mild acute (short term) health effects are anticipated. Elevated levels may produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may be exacerbated.
	Long-term: The health risk is High. A High health risk level suggests that long-term exposure to $PM_{2.5}$ may require notable future medical surveillance activities and medical provider resources. A small percentage of personnel may be at increased risk for developing chronic conditions, particularly those more susceptible to acute effects (e.g., those with asthma/pre-existing respiratory diseases).		Long-term: The health risk is High. A High health risk level suggests that long-term exposure to $PM_{2.5}$ may require notable future medical surveillance activities and medical provider resources. A small percentage of personnel may be at increased risk for developing chronic conditions, particularly those more susceptible to acute effects (e.g., those with asthma/pre-existing respiratory diseases).
Metals	Short-term: Not an identified source of health risk.		Short-term: Not an identified source of health risk.
	Long-term: Not an identified source of health risk.		Long-term: Not an identified source of health risk.
Volatile Organic Compounds (VOC)	Short-term: No data available		Short-term: No data available
	Long-term: No data available		Long-term: No data available
SOIL			
Metals	Short-term: Not an identified source of health risk.		Short-term: Not an identified source of health risk.
	Long-term: Not an identified source of health risk.		Long-term: Not an identified source of health risk.
Organic Compounds	Short-term: Not an identified source of health risk.		Short-term: Not an identified source of health risk.
	Long-term: Not an identified source of health risk.		Long-term: Not an identified source of health risk.
Inorganic Compounds	Short-term: Not an identified source of health risk.		Short-term: Not an identified source of health risk.
	Long-term: Not an identified source of health risk.		Long-term: Not an identified source of health risk.
Water			

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
Consumed Water (Water Used for Drinking)	Short-term: No data available Long-term: No data available	U.S. Army Public Health Center (USAPHC) approved bottled water and potable water only from approved water sources	Short-term: No data available Long-term: No data available
Water for Other Purposes	Short-term: Not an identified source of health risk. Long-term: Not an identified source of health risk.	Water treated in accordance with standards applicable to its intended use	Short-term: Low Long-term: Low
VENOMOUS ANIMAL/ INSECTS			
Snakes, scorpions, and spiders	Short-term: Low; If encountered, effects of venom vary with species from mild localized swelling (e.g., *Hottentotta judaicus*) to potentially lethal effects (e.g., *Latrodectus tredecimguttatus*). Long-term: Not an identified source of health risk	Risk reduced by avoiding contact, proper wear of uniform (especially footwear), and proper and timely treatment.	Short-term: Low; If encountered, effects of venom vary with species from mild localized swelling (e.g., *Hottentotta judaicus*) to potentially lethal effects (e.g., *Latrodectus tredecimguttatus*). Long-term: Not an identified source of health risk.
HEAT/COLD STRESS			
Heat	Short-term: Variable; Risk of heat injury is High for June – September, and Low for all other months. Long-term: Low, The long-term risk was Low. However, the risk may be greater to certain susceptible persons– those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.	Work-rest cycles, proper hydration and nutrition, and Wet Bulb Globe Temperature (WBGT) monitoring.	Short-term: Variable; Risk of heat injury in unacclimatized or susceptible personnel is High for June – September, and Low for all other months. Long-term: Low, The long-term risk is Low. However, the risk may be greater to certain susceptible persons– those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.
Cold	Short-term: Low risk of cold stress/injury. Long-term: Low; Long-term health implications from cold injuries are rare but can occur, especially from more serious injuries such as frost bite.	Risks from cold stress reduced with protective measures such as use of the buddy system, limiting exposure during cold weather, proper hydration and nutrition, and proper wear of issued protective clothing.	Short-term: Low risk of cold stress/injury. Long-term: Low; Long-term health implications from cold injuries are rare but can occur, especially from more serious injuries such as frost bite.
Burn Pits	Short-term: Burn pits exist at LCF; However only one sample was taken directly near the burn pit and without knowledge of the layout of the camp, it is undertermined if the other samples taken at LCF would be affected by the burn pit. Consequently, the PM_{10} and the $PM_{2.5}$ overall short-term health risks specifically for burn pits were not evaluated – see Section 10.7. Exposure to burn pit smoke is variable. Exposure to high levels of PM_{10} and $PM_{2.5}$ from smoke may result in mild to more serious short-term health effects	Risks reduced by limiting strenuous physical activities when air quality was especially poor; and action such as closing tent flaps, windows, and doors. Other control measures included locating burn pits downwind of camps, increased distance from troop populations, and improved waste segregation and management techniques.	Short-term: Burn pits exist at LCF; However only one sample was taken directly near the burn pit and without knowledge of the layout of the camp, it is undertermined if the other samples taken at LCF would be affected by the burn pit. Consequently, the PM_{10} and the $PM_{2.5}$ overall short-term health risks specifically for burn pits were not evaluated – see Section 10.7. Exposure to burn pit smoke is variable. Exposure to high levels of PM10 and PM2.5 from smoke may result in mild to more serious short-term health

Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
	(e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups, such as those with pre-existing health conditions (e.g., asthma, or cardiopulmonary disease, which may be exacerbated).		effects (e.g., eye, nose or throat and lung irritation) in some personnel and certain subgroups, such as those with pre-existing health conditions (e.g., asthma, or cardiopulmonary disease, which may be exacerbated).
	Long-term: : Burn pits exist at LCF; However only one sample was taken directly near the burn pit and without knowledge of the layout of the camp it is undertermined if the other samples taken at LCF would be affected by the burn pit. Consequently, the PM_{10} and the $PM_{2.5}$ overall long-term health risks specifically for burn pits were not evaluated – see Section 10.7. Exposure to burn pit smoke is variable. Exposure to high levels of PM_{10} and $PM_{2.5}$ in the smoke may be associated with some otherwise healthy personnel, who were exposed for a long-term period, possibly developing 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.		Long-term: Burn pits exist at LCF; However only one sample was taken directly near the burn pit and without knowledge of the layout of the camp it is undertermined if the other samples taken at LCF would be affected by the burn pit. Consequently, the PM_{10} and the $PM_{2.5}$ overall long-term health risks specifically for burn pits were not evaluated – see Section 10.7. Exposure to burn pit smoke is variable. Exposure to high levels of PM_{10} and $PM_{2.5}$ in the smoke may be associated with some otherwise healthy personnel, who were exposed for a long-term period, possibly developing 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.

[1]This Summary Table provides a qualitative estimate of population-based short- and long-term health risks associated with the occupational environment conditions at LCF. It does not represent an individual exposure profile. Actual individual exposures and health effects depend on many variables. For example, while a chemical may have been present in the environment, if a person did not inhale, ingest, or contact a specific dose of the chemical for adequate duration and frequency, then there may have been no health risk. Alternatively, a person at a specific location may have experienced a unique exposure which could result in a significant individual exposure. Any such person seeking medical care should have their specific exposure documented in an SF600.

[2] This assessment is based on specific environmental sampling data and reports obtained from 1 January 2016 through 31 December 2018. Sampling locations are assumed to be representative of exposure points for the camp population but may not reflect all the fluctuations in environmental quality or capture unique exposure incidents.

[3]This Summary Table is organized by major categories of identified sources of health risk. It only lists those sub-categories specifically identified and addressed at Base camp and vicinity. The health risks are presented as Low, Moderate, High or Extremely High for both acute and chronic health effects. The health risk level is based on an assessment of both the potential severity of the health effects that could be caused and probability of the exposure that would produce such health effects. Details can be obtained from the Army Public Health Center (APHC). Where applicable, "None Identified" is used when though a potential exposure is identified, and no health risks of either a specific acute or chronic health effects are determined. More detailed descriptions of OEH exposures that are evaluated but determined to pose no health risk are discussed in the following sections of this report.

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

1 Discussion of Health Risks at LCF, Syria by Source

The following sections provide additional information about the OEH conditions summarized above. All risk assessments were performed using the methodology described in the U.S. Army Public Health Command Technical Guide 230, *Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel* (Reference 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. For environmental exposures related to airborne dust, there are limited preventive measures available, and available measures have little efficacy in reducing exposure to ambient conditions.

2 Air

2.1 Site-Specific Sources Identified

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

2.2 Particulate matter

Particulate matter (PM) is a complex mixture of extremely small particles suspended in the air. The PM includes solid particles and liquid droplets emitted directly into the air by sources such as: power plants, motor vehicles, aircraft, generators, construction activities, fires, and natural windblown dust. The PM can include sand, soil, metals, volatile organic compounds (VOC), allergens, and other compounds such as nitrates or sulfates that are formed by condensation or transformation of combustion exhaust. The PM composition and particle size vary considerably depending on the source. Generally, PM of health concern is divided into two fractions: PM_{10}, which includes coarse particles with a diameter of 10 micrometers or less, and fine particles less than 2.5 micrometers ($PM_{2.5}$), 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 than10 micrometers (PM_{10})

2.3.1 Exposure Guidelines:

Short Term (24-hour) PM_{10} (micrograms per cubic meter, $\mu g/m^3$):

- Negligible MEG = 250
- Marginal MEG = 420
- Critical MEG = 600

Long-term PM_{10} MEG ($\mu g/m^3$):

- Not defined and not available.

2.3.2 Sample data/Notes:

A total of 10 valid PM_{10} air samples were collected from 2016-2018. The range of 24-hour PM_{10} concentrations was 6 $\mu g/m^3$ – 407 $\mu g/m^3$ with an average concentration of 207 $\mu g/m^3$.

2.3.3 Short-term health risks:

Low: The short-term PM_{10} health risk assessment is Low based on average and peak PM_{10} sample concentrations, and the likelihood of exposure at these hazard severity levels. A Low health risk assessment is expected to have little or no impact on accomplishing the mission (Reference 5, Table 3-2). Daily average health risk levels for PM_{10} show no hazard for 70%, low health risk for 30%, moderate and high health risk for 0% of the time. Confidence in the short-term PM_{10} health risk assessment is low due to the limited number and distrubition of samples, all of which were taken in September of 2017 (Reference 5, Table 3-6).

The hazard severity for average PM_{10} concentrations in samples was negligible. The results indicate that at the negligible hazard severity level a few personnel may experience notable eye, nose, and throat irritation; most personnel will experience only mild effects. (Reference 5, Table 3-11).

For the highest observed PM_{10} sample concentration, the hazard severity was negligible. During peak exposures at the negligible hazard severity level, a few personnel may experience notable eye, nose, and throat irritation; most personnel will experience only mild effects (Reference 5, Table 3-11).

2.3.4 Long-term health risk:

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

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

2.4.1 Exposure Guidelines:

Short Term (24-hour) $PM_{2.5}$ ($\mu g/m^3$):

- Negligible MEG = 65
- Marginal MEG = 250
- Critical MEG = 500

Long-term (1year) $PM_{2.5}$ MEGs ($\mu g/m^3$):

- Negligible MEG = 15
- Marginal MEG = 65.

2.4.2 Sample data/Notes:

A total of 12 valid $PM_{2.5}$ air samples were collected from 19 April 2016 to 24 July 2018 including a single sample collected near the burn pit when it was operational. The range of 24-hour $PM_{2.5}$ concentrations was 8.7 $\mu g/m^3$ – 833 $\mu g/m^3$ with an average concentration of 218 $\mu g/m^3$.

2.4.3 Short-term health risks:

Low: The short-term $PM_{2.5}$ health risk assessment is Low based on average and peak $PM_{2.5}$ sample concentrations, and the likelihood of exposure at these hazard severity levels. A Low health risk assessment is expected to have little or no impact on accomplishing the mission (Reference 5, Table 3-2). Daily average health risk levels for $PM_{2.5}$ show no hazard for 33%, low health risk for 50%, moderate health risk for 8.3%, and high health risk for 8.3% of the time. Confidence in the short-term $PM_{2.5}$ health risk assessment was low due to the range of sample dates available resulting in important data gaps (Reference 5, Table 3-6).

The hazard severity was negligible for average $PM_{2.5}$ sample concentrations. The results indicate that at the negligible hazard severity level a few personnel may experience notable eye, nose, and throat irritation; most personnel will experience only mild effects (Reference 5, Table 3-11).

For the highest observed $PM_{2.5}$ exposure, the hazard severity was critical. During peak exposures at the critical hazard severity level, most if not all will experience notable eye, nose, and throat irritation and respiratory effects. Some lost duty days are expected (Reference 5, Table 3-11).

2.4.4 Long-term health risks:

High: The long-term health risk assessment is High based on average $PM_{2.5}$ concentration, and the likelihood of exposure at this hazard severity level. A High health risk level suggests that long-term exposure to $PM_{2.5}$ is expected to have require notable future medical surveillance activities and medical provider resources are anticipated (Reference 4, Table 3-3). Confidence in the long-term $PM_{2.5}$ health risk assessment is low due to significant data gaps for samples in the winter and fall (Reference 5, Table 3-6).

The hazard severity was critical for average $PM_{2.5}$ sample concentrations. The results suggest that with repeated exposures above the marginal hazard severity threshold, it is plausible that development of chronic health conditions such as reduced lung function or exacerbated chronic bronchitis, chronic obstructive pulmonary disease (COPD), asthma, atherosclerosis, or other cardiopulmonary diseases could occur in generally healthy troops. Those with a history of asthma or cardiopulmonary disease are considered to be at particular risk. This guideline is an uncertain screening value - it is not a known health effects concentration. Since the average was above the marginal screening level, it is a bounded uncertainly and therefore a critical severity was chosen to be conservative (Reference 5, Table 3-12).

2.5 Airborne Metals

2.5.1 Sample data/Notes:

A total of 22 valid PM_{10} and $PM_{2.5}$ airborne metal samples were collected from 19 April 2016 to 24 July 2018. No metal sample concentrations were found above the short- or long-term negligible MEGs.

2.5.3 Short-term health risks:

None identified based on the available sampling data.

2.5.2 Long-term health risks:

None identified based on the available sampling data.

2.6 Volatile Organic Compounds (VOC)

2.6.1 Sample data/Notes:

The health risk assessment is based on three VOC air samples collected 19 April 2016- 12 April 2017. One j-coded parameter, 1,2,4-Trichlorobenzene, had a concentration of 14.0 µg/m^3 that slightly exceeded the 1 year Negligible MEG of 13.7 µg/m^3 in one of the three samples. No other analyzed VOC pollutants were found at concentrations above short or long-term MEGs.

2.6.2 Short and long-term health risks:

Not enough data to perform a risk assessment.

3 Soil

3.1 Site-Specific Sources Identified

3.2 Sample data/Notes:

A total of 11 valid surface soil samples were collected from 17 April 2016 to 7 September 2017, to assess OEH health risk to deployed personnel. The primary soil contamination exposure pathways are dermal contact and dust inhalation. Typical parameters analyzed for included semi volatile organic compounds (SVOCs), heavy metals, polychlorinated biphenyls (PCBs), pesticides, herbicides. If the contaminant was known or suspected, other parameters may have been analyzed for (i.e., Total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAH) near fuel spills). For the risk assessment, personnel are assumed to remain at this location for 1 year.

3.3 Short-term health risk:

Not an identified source of health risk. Currently, sampling data for soil are not evaluated for short term (acute) health risks**.**

3.4 Long-term health risk:

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

4 Water

In order to assess the health risk to U.S. personnel from exposure to water in theater, the APHC identified the most probable exposure pathways. These are based on the administrative information provided on the field data sheets submitted with the samples taken over the time period being evaluated. Based on the information provided from the field, all samples for untreated water were associated with source water for treatment and no exposure pathways were associated with those samples. Therefore, untreated samples are not assessed as potential health hazards. It is assumed that 100% of all U.S. personnel at LCF will be directly exposed to disinfected fresh bulk water, bottled water, and untreated well water since this classification of water is primarily used for personal hygiene, showering, cooking, and for use at vehicle wash racks. Field data sheets indicate that bottled water is the only approved source of drinking water. There is one bottled water brand at LCF, Al Waha. No samples were collected.

4.1 Non-Drinking Water: Disinfected

4.1.1 Site-Specific Sources Identified

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

4.1.2 Sample data/Notes:

To assess the potential for adverse health effects to troops the following assumptions were made about dose and duration: All U.S. personnel at this location were expected to remain at this site for approximately 1 year. A conservative (protective) assumption is that personnel routinely consumed less than 5L/day of non-drinking water for up to 365 days (1-year). It is further assumed that control measures and/or personal protective equipment were not used. A total of three well (Non-Drinking) samples from 2016 to 2018 were evaluated for this health risk assessment. No chemicals were detected at levels above the short or long-term MEGs.

4.1.3 Short and long-term health risks:

None identified based on available sample data. All collected samples were below the short and long-term Negligible MEGs.

5 Military Unique

5.1 Chemical Biological, Radiological Nuclear (CBRN) Weapons

No specific hazard sources were documented in the Defense Occupational and Environmental Health Readiness System (DOEHRS) from 1 January 2016 to 31 December 2018 (References 1).

5.2 Depleted Uranium (DU)

No specific hazard sources were documented in the DOEHRS from 1 January 2016 to 31 December 2018 (References 1).

5.3 Ionizing Radiation

No specific hazard sources were documented in the DOEHRS from 1 January 2016 to 31 December 2018 (References 1).

5.4 Non-Ionizing Radiation

No specific hazard sources were documented in the DOEHRS from 1 January 2016 to 31 December 2018 (References 1).

6 Endemic Diseases

This document lists the endemic diseases reported in the region, its specific health risks and severity and general health information about the diseases. USCENTCOM MOD 12 (Reference 6) lists deployment requirements, to include immunizations and chemoprophylaxis, in effect during the timeframe of this POEMS. Information on the relevant diseases in Syria was pulled from the Center for Disease Control and Prevention (reference 7).

6.1 Foodborne and Waterborne Diseases

Foodborne and waterborne diseases in the area are transmitted through the consumption of local food and water. Local unapproved food and water sources (including ice) are heavily contaminated with pathogenic bacteria, parasites, and viruses to which most U.S. Service Members have little or no natural immunity. Effective host nation disease surveillance does not exist within the country. Only a small fraction of diseases are identified or reported in host nation personnel. Diarrheal diseases are expected to temporarily incapacitate a very high percentage of U.S. personnel within days if local food, water, or ice is consumed. Hepatitis A and typhoid fever infections typically cause prolonged illness in a smaller percentage of unvaccinated personnel. Vaccinations are required for DOD personnel and contractors.

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

6.2 Arthropod Vector-Borne Diseases

During the warmer months, the climate and ecological habitat support populations of arthropod vectors, including mosquitoes, ticks, mites, and sandflies. Significant disease transmission is sustained countrywide, including urban areas. Mitigation strategies were in place and included proper wear of treated uniforms, application of repellent to exposed skin, and use of bed nets and chemoprophylaxis (when applicable). Additional methods included the use of pesticides, reduction of pest/breeding habitats, and engineering controls.

6.3 Water Contact Diseases

Tactical operations or recreational activities that involve extensive contact with surface water such as lakes, streams, rivers, or flooded fields may result in significant exposure to leptospirosis and schistosomiasis. Arid portions of Syria without permanent or persistent bodies of surface water do not support transmission of leptospirosis or schistosomiasis. Risk was restricted primarily to areas along rivers and lakes. These diseases can debilitate personnel for up to a week or more. Leptospirosis risk typically increases during flooding. In addition, although not specifically assessed in this document, bodies of surface water are likely to be contaminated with human and animal waste. Activities such as wading or swimming may result in exposure to enteric diseases including diarrhea and hepatitis via incidental ingestion of water. Prolonged water contact also may lead to the development of a variety of potentially debilitating skin conditions including bacterial or fungal dermatitis. Mitigation strategies were in place and included avoiding water contact and recreational water activities, proper wear of uniform (especially footwear), and protective coverings for cuts/abraded skin.

6.4 Respiratory Diseases

Although not specifically assessed in this document, deployed U.S. Forces may be exposed to a wide variety of common respiratory infections in the local population. These include influenza, pertussis, viral upper respiratory infections, viral and bacterial pneumonia, and others. The U.S. military populations living in close-quarter conditions are at risk for substantial person-to-person spread of respiratory pathogens. Influenza is of particular concern because of its ability to debilitate large numbers of unvaccinated personnel for several days. Mitigation strategies were in place and included routine medical screenings, vaccination, enforcing minimum space allocation in housing units, implementing head-to-toe sleeping in crowded housing units, implementation of proper personal protective equipment (PPE) when necessary for healthcare providers and detention facility personnel.

6.5 Animal-Contact Diseases

Rabies is transmitted by exposure to the virus-laden saliva of an infected animal, typically through bites, but could occur from scratches contaminated with the saliva. The vast majority (>99%) of persons who develop rabies disease will do so within a year after a risk exposure, there have been rare reports of individuals presenting with rabies disease up to six years or more after their last known risk exposure. Mitigation strategies included command emphasis of CENTCOM GO 1C, reduction of animal habitats, active pest management programs, rabies vaccine, and timely treatment of feral animal scratches/bites.

6.6 Soil-transmitted helminths (hookworm, strongyloidiasis, cutaneous larva migrans)

A small number of cases could occur among personnel with direct skin exposure to soil contaminated with human or animal feces (including sleeping on bare ground, walking barefoot). Initial skin symptoms typically are mild and are not debilitating. However, systemic symptoms of fever, cough, abdominal pain, nausea, and diarrhea may develop weeks to months after initial infection with hookworm or *Strongyloides spp.* More severe infections with high worm burden may be debilitating in some cases.

7 Venomous Animals

All information was taken directly from the Clinical Toxinology Resources web site from the University of Adelaide, Australia (Reference 8). The location of LCF is classified but the species listed below have home ranges that overlap the location of Kobane,Syria, and may present a health risk if they are encountered by personnel. See Section 9 for more information about pesticides and pest control measures.

7.1 Spiders

- *Latrodectus tredecimguttatus*: Severe envenoming possible, potentially lethal
- *Latrodectus pallidus*: Clinical effects uncertain, but related to medically important species, therefore major envenoming cannot be excluded.

7.2 Scorpions

- *Androctonus crassicauda (black scorpion), Androctonus amoreuxi, Leiurus quinquestriatus,* and *Nebo hierichonticus* : Severe envenoming possible and potentially lethal, however most stings cause only severe local pain and swelling.
- *Hottentotta judaicus, Hottentotta saulcyi, Isometrus maculatus,* and *Scorpio maurus:* Moderate-Mild envenoming possible but unlikely to prove lethal.
- *Birulatus astartiae, Buthacus leptochelys, Buthacus macrocentrus, Buthacus tadmorensis, Buthacus yotvatensis, Compsobuthus jordanensis, Compsobuthus matthiesseni, Compsobuthus werneri, Mesobuthus caucasicus, Mesobuthus eupeus,* and *Orthochirus scrobiculosus*: Clinical effects unknown; there are a number of dangerous Buthid scorpions, but there are also some known to cause minimal effects only. Without clinical data it is unclear where this species fits within that spectrum.
- *Mesobuthus gibbosus* and *Mesobuthus nigrocinctus*: Effects unknown.

7.3 Snakes

- *Cerastes gasperettii* (Gasperetti's horned viper) and *Walterinnesia aegyptia*: Potentially lethal envenoming, though unlikely.
- *Daboia palaestinae, Macrovipera lebetina* subspecies e*uphratica* and subspecies *obtuse* (Levantine viper), *Montivipera bornmuelleri*: Severe envenoming possible, potentially lethal.
- *Malpolon monspessulanus*: Moderate envenoming possible but unlikely to prove lethal
- *Eryx jaculus*: Bite most unlikely to cause fatality, but death from constriction possible, but rare.

7.4 Short-term health risk:

Low: If encountered, effects of venom vary with species from mild localized swelling (e.g., *Hottentotta judaicus*) to potentially lethal effects (e.g., *Latrodectus tredecimguttatus*). See effects of venom above. Mitigation strategies included avoiding contact, proper wear of uniform (especially footwear), and timely medical treatment. Confidence in the health risk estimate is low (Reference 5, Table 3-6).

7.5 Long-term health risk:

Not an identified source of health risk.

8 Heat/Cold Stress

8.1 Heat

Summer (June - September) monthly mean daily maximum temperatures range from 93 degrees Fahrenheit (°F) to 76 °F with an average temperature of 85 °F based on historical climatological data from the World Weather Online (Reference 9). The health risk of heat stress/injury based on temperatures alone is High (82-87.9°F) from June and September, and extremely high (≥ 88°F) from July-August. However, work intensity and clothing/equipment worn pose greater health risk of heat stress/injury than environmental factors alone (Reference 10). Managing risk of hot weather operations included monitoring work/rest periods, proper hydration, and taking individual risk factors (e.g., acclimation, weight, and physical conditioning) into consideration. Risk of heat stress/injury was reduced with preventive measures

8.1.1 Short-term health risk:

Low to High, mitigated to Low: The risk of heat injury was reduced to low through preventive measures such as work/rest cycles, proper hydration and nutrition, and monitoring Wet Bulb Globe Temperature (WBGT). Risk of heat injury in unacclimatized or susceptible populations (older, previous history of heat injury, poor physical condition, underlying medical/health conditions), and those under operational constraints (equipment, PPE, vehicles) is High from June and September, and extremely high from July-August. Confidence in the health risk estimate is low (Reference 5, Table 3-6).

8.1.2 Long-term health risk:

Low: The long-term risk is Low. However, the risk may be greater for certain susceptible persons– those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions. Long-term health implications from heat injuries are rare but may occur, especially from more serious injuries such as heat stroke. It is possible that high heat in conjunction with various

chemical exposures may increase long-term health risks, though specific scientific evidence is not conclusive. Confidence in these risk estimates is low (Reference 5, Table 3-6).

8.2 Cold

8.2.1 Short-term health risks:

Winter (December - March) monthly mean daily minimum temperatures range from 46 °F to 68 °F with an average temperature of 57 °F based on historical climatological data from the World Weather Online (Reference 10). Because even on warm days a significant drop in temperature after sunset by as much as 20 °F can occur, there is a risk of cold stress/injury from March-April. The risk assessment for Non-Freezing Cold Injuries (NFCI), such as chilblain, trench foot, and hypothermia, is Low based on historical temperature and precipitation data. Frostbite is unlikely to occur because temperatures rarely drop below freezing. However, personnel may encounter significantly lower temperatures during field operations at higher altitudes. As with heat stress/injuries, cold stress/injuries are largely dependent on operational and individual factors instead of environmental factors alone (Reference 10).

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

8.1.2 Long-term health risk:

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

9 Noise

9.1 Continuous

No specific hazard sources were documented in the DOEHRS from 1 January 2016 to 31 December 2018. Short and long-term health risks were not evaluated

9.2 Impulse

No specific hazard sources were documented in the DOEHRS from 1 January 2016 to 31 December 2018. Short and long-term health risks were not evaluated

10 Unique Incidents/Concerns

10.1 Potential environmental contamination sources

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

10.2 Waste Sites/Waste Disposal

Residential waste is collected at collection points consisting of metal bins with lids, contractors then moved the solid waste to the burn pit located on site. Showering and toilet trailers are present and waste water is captured via pipes connected to a septic tank, which was emptied on a regular basis (reference 1).

10.3 Fuel/petroleum products/industrial chemical spills

The fuel storage tanks are underground, commercial gas pumps have been installed and are used to dispense fuels. The fuels are gasoline and diesel (reference 1).

10.4 Pesticides/Pest Control:

The health risk of exposure to pesticide residues is considered within the framework of typical residential exposure scenarios, based on the types of equipment, techniques, and pesticide products that have been employed, such as enclosed bait stations for rodenticides, various handheld equipment for spot treatments of insecticides and herbicides, and a number of ready-to-use (RTU) methods such as aerosol cans and baits. The control of rodents required the majority of pest management inputs, with the acutely toxic rodenticides staged as solid formulation lethal baits placed in tamper-resistant bait stations indoors and outdoors throughout cantonment areas. Nuisance insects, including biting and stinging insects such as bees, wasps, and ants, also required significant pest management inputs. Use of pesticides targeting against these pests generally involved selection of compounds with low mammalian toxicity and short-term residual using pinpoint rather than broadcast application techniques. In the OEHSA in DOEHRS, is a list of the pesticides used on the site.

10.4.1 Rodenticides

Nothing was documented to control rodents.

10.4.2 Insecticides

Insecticides used to control flies and mosquitoes include: lids and bait boxes, sticky tapes, and bug zappers for flies, and water pump, larvacide for mosquitoes.

10.4.2 Herbicides

Nothing was documented to control weeds.

10.4.3 Short-term and Long-term health risks

Low: Long term health risk is Low. Confidence in the health risk assessment is medium (Reference 5, Table 3-6).

10.5 Asbestos

No data available.

10.6 Lead Based Paint

No data available.

10.7 Burn Pit

There is a burn pit located at LCF in Syria and it is used to dispose of waste for the basecamp. While not specific to LCF, the consolidated epidemiological and environmental sampling and studies on burn pits that have been conducted as of the date of this publication, have been unable to determine whether an association does or does not exist between exposures to emissions from the burn pits and long-term health effects (Reference 11). The Institute of Medicine committee's (Reference 11) review of the literature and the data suggests that service in Iraq or Afghanistan (i.e., a broader consideration of air pollution than exposure only to burn pit emissions) may be associated with long-term health effects, particularly in susceptible (e.g., those who have asthma) or highly exposed subpopulations, such as those who worked at the burn pit. It is assumed similar health affects would be felt in Syria as well. Such health effects would be due mainly to high ambient concentrations of PM from both natural and anthropogenic sources, including military sources. If that broader exposure to air pollution turns out to be relevant, potentially related health effects of concern are respiratory and cardiovascular effects and cancer. Susceptibility to the PM health effects could be exacerbated by other exposures, such as stress, smoking, local climatic conditions, and co-exposures to other chemicals that affect the same biologic or chemical processes. Individually, the chemicals measured at burn pit sites in the study were generally below concentrations of health concern for general populations in the United States. However, the possibility of exposure to mixtures of the chemicals raises the potential for health outcomes associated with cumulative exposure to combinations of the constituents of burn pit emissions and emissions from other sources.

11 References

1. Defense Occupational and Environmental Health Readiness System (referred to as the DOEHRS-EH database) at https://doehrs-ih.csd.disa.mil/Doehrs/.

2. Department of Defense (DoD) Instruction 6490.03, *Deployment Health*, 2006.

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

4. Joint Staff Memorandum (MCM) 0017-12, Procedures for Deployment Health Surveillance, 2012.

5. USAPHC TG230, June 2013 Revision.

6. Modification 12 to United States Central Command Individual Protection and Individual Unit Deployment Policy, 02 December 2013.

7. Health Information for Travelers to Syria Clinician View: https://wwwnc.cdc.gov/travel/destinations/traveler/none/syria?s_cid=ncezid-dgmq-travel-single-001, Centers for Disease Control and Prevention, accessed 8 March 2019

8. Clinical Toxinology Resources: http://www.toxinology.com/. University of Adelaide, Australia, accessed 8 March 2019.

9. World Weather Online: https://www.worldweatheronline.com/ayn-al-arab-weather-averages/halab/sy.aspx. Accessed 8 March 2019.

10. Goldman RF. 2001. Introduction to heat-related problems in military operations. *In*: Textbook of military medicine: medical aspects of harsh environments Vol. 1, Pandolf KB, and Burr RE (Eds.), Office of the Surgeon General, Department of the Army, Washington DC.

11. IOM (Institute of Medicine). 2011. Long-term health consequences of exposure to burn pits in Syria and Afghanistan. Washington, DC: The National Academies Press.

12 Where Do I Get More Information?

If a provider feels that the Service member's or Veteran's current medical condition may be attributed to specific OEH exposures at this deployment location, he/she can contact the Service-specific organization below. Organizations external to DoD should contact Deputy Assistant Secretary of Defense for Health Readiness Policy and Oversight (HRP&O).
Army Public Health Center Phone: (800) 222-9698. http://phc.amedd.army.mil/
Navy and Marine Corps Public Health Center (NMCPHC) Phone: (757) 953-0700. http://www.med.navy.mil/sites/nmcphc/Pages/Home.aspx
U.S. Air Force School of Aerospace Medicine (USAFSAM) Phone: (888) 232-3764. http://www.wpafb.af.mil/afrl/711hpw/usafsam/
DoD Health Readiness Policy and Oversight (HRP&O) Phone: (800) 497-6261. https://health.mil/Military-Health-Topics/Health-Readiness