

Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS):
Raqqah and Vicinity, Syria
Calendar Years: 2015-2020

AUTHORITY: This POEMS has been developed in accordance with Department of Defense Instructions 6490.03 and 6055.05 (References 2, 3).

PURPOSE: This POEMS documents the Department of Defense (DoD) assessment of occupational and environmental health (OEH) risk for Raqqah, Syria and vicinity which includes Taqbqah. 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 01 January 2015 through 31 December 2020 to include deployment OEH surveillance 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 Raqqah and vicinity during this period was performed at representative exposure points selected to characterize health risks at the population-level. Due to the nature of environmental sampling, the data upon which this report is based may not be fully representative of all the fluctuations in environmental quality or capture unique occurrences. Note that surveillance efforts were significantly impacted by the SARS-CoV2 pandemic (March 2020 to 31 December 2020).

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

SITE DESCRIPTION:

Firebase Raqqah is located in north-central Syria in the vicinity of the city of Ar Raqqah and is situated approximately 800 feet above sea level. The site is surrounded by farmland and rural communities. The area is sparsely vegetated with no surface water nearby. The climate varies from sweltering, arid, windy, and clear in the summer to cold, dry, and partly cloudy in the winter. Precipitation is concentrated in the months of October to April, with minimal precipitation from May through September. Strong winds can create dust storms, especially during the spring and summer.

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 Raqqah and vicinity. As indicated in the detailed sections that follow Table 2, controls established to reduce health risk were factored into this assessment. In some cases, e.g., ambient air, specific controls are noted, but not routinely available/feasible.

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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 Raqqah and vicinity:

For heat stress, risk can be greater during months of May 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 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 not evaluated due to insufficient data for analysis. However, the Raqqah area is a dust-prone desert environment, with an arid climate, also subject to vehicle traffic. Consequently, exposures to 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_{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. Burn pits were not located at Raqqah and vicinity during the 2015 – 2020 timeframe. Although most short-term health 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 while at Raqqah and vicinity. Personnel who reported with symptoms or required treatment should have exposure and treatment noted in the 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 Raqqah 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 not evaluated due to insufficient data for analysis. However, the Raqqah area is a dust-prone desert environment with an arid climate, also subject to vehicle traffic, and conditions may have varied. Burn pits were not located at Raqqah and vicinity during the 2015 – 2020 timeframe. For inhalational exposure to high levels of dust containing 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 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/boxes, 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 – Raqqah and Vicinity, Syria^{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 2.5 micrometers in diameter (PM _{2.5})	Short-term: Insufficient data to assess short-term health risk. Because Raqqah and vicinity are situated in a dusty semi-arid 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: Insufficient data to assess short-term health risk. Because Raqqah and vicinity are situated in a dusty semi-arid 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: Insufficient data to assess long-term health risk. However, due to the local environment, 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: Insufficient data to assess long-term health risk. However, due to the local environment, 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: Not an identified source of health risk.		Short-term: Not an identified source of health risk.
	Long-term: Insufficient data to assess long-term health risk.		Long-term: Insufficient data to assess long-term health risk.
SOIL			
Metals, Organic Compounds, Inorganic Compounds	Not an identified source of health risk.		Not an identified source of health risk.
WATER			
Consumed Water (Water Used for Drinking)	Short-term: Not an identified source of health risk.	U.S. Army Public Health Center (USAPHC) [former U.S. Army Veterinary Command (VETCOM)] approved bottled water and potable water only from approved water sources	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 for Other Purposes	Short-term: Not an identified source of health risk.	Water treated in accordance with standards applicable to its intended use	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.
ENDEMIC DISEASE			
Food borne /Waterborne (e.g., diarrhea-bacteriological)	Risk levels are no longer provided in Section 6 (Endemic Diseases) for each endemic disease since the National Center for Medical Intelligence website is no longer being	Refer to Section 6 for preventive measures	Risk levels are no longer provided in Section 6 (Endemic Diseases) for each endemic disease since the National Center for Medical Intelligence website is no longer being updated. The

Source of Identified Health Risk ³	Unmitigated Health Risk Estimate ⁴	Control Measures Implemented	Residual Health Risk Estimate ⁴
Arthropod Vector Borne Water-Contact (e.g., wading, swimming) Respiratory Animal Contact Aerosolized Dust or Soil-contact	updated. The OEHSAs provide risk levels for particular endemic diseases; however, it is not specified how the risk levels were obtained. Although risk levels are no longer provided, country specific endemic diseases can be found in Section 6.		OEHSAs provide risk levels for particular endemic diseases; however, it is not specified how the risk levels were obtained. Although risk levels are no longer provided, country specific endemic diseases can be found in Section 6.
VENOMOUS ANIMALS			
Snakes, scorpions, and spiders	Short-term: Low; If encountered, effects of venom vary with species from mild localized swelling to potentially lethal effects.	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 to potentially lethal effects.
	Long-term: No data available		Long-term: No data available
HEAT/COLD STRESS			
Heat	Short-term: Variable; Risk of heat injury is High from May – September and Low from October – April.	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 May-September and Low for all others.
	Long-term: Low, The long-term risk was Low. However, the risk may be greater to certain susceptible persons—those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.		Long-term: Low, The long-term risk is Low. However, the risk may be greater to certain susceptible persons—those older (i.e., greater than 45 years), in lesser physical shape, or with underlying medical/health conditions.
Cold	Short-term: Low risk of cold stress/injury.	Risks from cold stress reduced with protective measures such as use of the buddy system, limiting exposure during cold weather, proper hydration and nutrition, and proper wear of issued protective clothing.	Short-term: Low risk of cold stress/injury.
	Long-term: Low; Long-term health implications from cold injuries are rare.		Long-term: Low; Long-term health implications from cold injuries are rare.
NOISE			
Continuous (Flight Operations, Power Production)	Short-term: Low	Risk may have been reduced by appropriate hearing protection used by personnel in higher risk areas (around major sources of continuous noise such as flight line and landing zone, and power production (e.g., generators)).	Short-term: Low
	Long-term: Low		Long-term: Low

1 This Summary Table provides a qualitative estimate of population-based short- and long-term health risks associated with the occupational and environment health conditions at Raqqah and vicinity. 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 01 January 2015 through 31 December 2020. 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 Raqqah 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 APHC. Where applicable, "None Identified" is used when though a potential exposure is identified, 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 Raqqah and Vicinity, 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 (USAPHC) Technical Guide 230, *Environmental Health Risk Assessment and Chemical Exposure Guidelines for Deployed Military Personnel* (Reference 4). All OEH risk estimates represent residual risk after accounting for preventive controls in place. Occupational exposures and exposures to endemic diseases are greatly reduced by preventive measures. For environmental exposures related to airborne dust, there are limited preventive measures available, and available measures have little efficacy in reducing exposure to ambient conditions.

2 Air

2.1 Site-Specific Sources Identified

Ambient blowing dust from vehicle traffic on unpaved roads and from rotary-wing aircraft operations are noted as major contributors to air pollution in this area. Additional emissions from military operations included power generators and vehicle fueling.

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/cardiopulmonary conditions) are at greatest risk of developing notable health effects. The air pollution exposure risks assessed in this POEMS focuses on ambient exposures as indicated through sampling records.

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, 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: PM₁₀, which includes coarse particles with a diameter of 10 micrometers or less, and fine particles less than 2.5 micrometers in diameter (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. Since PM_{2.5} is the best biological indicator of health risk, PM₁₀ was not evaluated.

2.3 Particulate Matter, less than 2.5 micrometers (PM_{2.5})

2.3.1 Exposure Guidelines:

Short Term (24-hour) PM_{2.5} (µg/m³):

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

Long-term (1-year) PM_{2.5} MEGs (µg/m³):

- Negligible MEG = 15
- Marginal MEG = 65

2.3.2 Sample data/Notes:

One valid PM_{2.5} air sample was collected on 19 June 2019. The 24-hour PM_{2.5} concentration was 96 µg/m³. No other samples were recorded within DOEHRS.

2.3.3 Short-term health risks:

Insufficient data available to assess short-term risk

2.3.4 Long-term health risks:

Insufficient data available to assess long-term risk

2.4 Airborne Metals

2.4.1 Sample data/Notes:

One valid airborne metals sample was collected on 19 June 2019. No metals were detected above their respective short- or long-term MEGs.

2.4.2 Short-term and long-term health risks:

Insufficient data available to assess risk

2.5 Volatile Organic Compounds

2.5.1 Sample data/Notes:

No volatile organic compounds samples were collected from 2015-2020.

2.5.2 Short-term and long-term health risks:

No data available to assess risk

3 Soil

3.1 Site-Specific Sources Identified

No specific sources of soil contamination were documented. Previous land usage was unknown. Hazardous materials and fuel were stored on site, but no evidence of spills or leaks were reported.

3.2 Soil Samples

3.2.1 Sample data/Notes:

No soil samples were collected from 2015-2020.

3.2.2 Short-term and long-term health risks:

No data available to assess risk

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. Field data sheets indicate that bottled water is the only approved source of drinking water. It is assumed that 100% of all U.S. personnel at Raqqah and vicinity were directly exposed to disinfected fresh bulk water since this classification of water is primarily used for personal hygiene and showering. Based on the information provided from the field, the untreated water sample was chlorinated river water that may not have been otherwise treated. Therefore, the untreated sample is assessed for potential health hazards.

4.1 Drinking Water: Bottled

4.1.1 Site-Specific Sources Identified

Drinking water is procured from a U.S. Army approved source of commercial bottled water (reference 5). The only brand identified in use is Al Waha®.

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: A conservative (protective) assumption was that personnel routinely ingested 5 liters per day (L/day) of bottled water for up to 365 days (1-year). It was further assumed that proper storage (e.g., under cover, not exposed to direct sunlight, not adjacent to potential contaminants such as fuel) were the only control measures used. No bottled drinking water samples were collected and submitted for laboratory analysis.

No field test results were recorded in DOEHRS.

4.1.3 Short-term and long-term health risk:

No data available to assess risk

4.2 Non-Drinking Water: Disinfected Fresh/Treated

4.2.1 Site-Specific Sources Identified

The non-drinking water supply was reported to be filtered water from the Euphrates River that is disinfected within transport trucks that deliver the water to Raqqah. Although the primary route of exposure for most microorganisms is ingestion of contaminated water, dermal exposure to some microorganisms, chemicals, and biologicals may also cause adverse health effects. Complete exposure pathways would include drinking, brushing teeth, personal hygiene, cooking, providing medical and dental care using a contaminated water supply or during dermal contact at vehicle or aircraft wash racks.

4.2.2 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 (PPE) were not used.

Treated water kit: During 2015-2020 one sample was collected in a treated water kit and submitted for laboratory analysis. The sample was collected from a kitchen trailer sink on 03 October 2018. No chemical concentrations exceeded the short- or long-term 1-year 5 liter per day (L/day) MEGs. Note that total dissolved solids (TDS) were measured at 540 milligrams per liter (mg/L), above the potability standard of 500 mg/L. However, the field test result reported on the sample field data sheet was 320 mg/L.

Raw (untreated) water kit: One untreated water kit sample was collected on 19 June 2019. The field data sheet noted the water was chlorinated and did not indicate that it had also been filtered. The sample was collected from a shower in the shower facility. No chemical concentrations exceeded the 1-year 5 L/day MEGs. Two parameters, aluminum (0.29 mg/L) and turbidity (9.1 Nephelometric turbidity units (NTU)), exceeded their potability standards of 0.20 mg/L and 1.0 NTU, respectively. The field data sheet also indicated the sample was positive for total coliforms and *Escherichia coli* (*E. coli*) despite a reported free available chlorine concentration of 3 mg/L.

4.2.3 Short-term and long-term health risks:

Insufficient data available to assess chemical risk. The positive field test for *E. coli* indicates the potential for short-term health risk to exposed personnel; no additional follow-up information was available. However, there were also no reported health issues related to *E. coli* exposure.

5 Military Unique

5.1 Chemical, Biological, Radiological, Nuclear Weapons

No specific hazard sources were documented in the Defense Occupational and Environmental Health Readiness System (DOEHRS) from 01 January 2015 to 31 December 2020 (Reference 1).

5.2 Depleted Uranium

No specific hazard sources were documented in DOEHRS for the 01 January 2015 to 31 December 2020 timeframe (Reference 1).

5.3 Ionizing Radiation

No specific hazard sources were present per the information recorded in DOEHRS for the 01 January 2015 to 31 December 2020 timeframe (Reference 1).

5.4 Non-Ionizing Radiation

No specific hazard sources were present per the information recorded in DOEHRS for the 01 January 2015 to 31 December 2020 timeframe (Reference 1).

6 Endemic Diseases

This document lists the endemic diseases reported in the region by the Centers for Disease Control and Prevention (reference 12) and general health information about the diseases. Table 3 below provides a summary of the risk estimates documented in the annual OEHSAs for Raqqah through the

method(s) used to generate the risk estimates were not specified. The CENTCOM Modifications (MOD) 13, 14, and 15 (References 6, 7, 8) list deployment requirements, to include immunizations and chemoprophylaxis, in effect during the timeframe of this POEMS.

Table 3. Disease Threat Risk Assessment in Raqqah OEHSAs

Disease Threat	Hazard Severity	Hazard Probability	Risk Estimate
Leishmaniasis (Cutaneous)	Critical	Seldom	Moderate
Leishmaniasis (Visceral)	Marginal	Seldom	Low
Sand Fly Fever	Critical	Seldom	Moderate
Q Fever	Marginal	Occasional	Moderate
Leptospirosis	Marginal	Unlikely	Low
Crimean-Congo Hemorrhagic Fever (CCHF)	Critical	Seldom	Moderate
Schistosomiasis (Bilharziasis or Snail Fever)	Critical	Seldom	Moderate
Diarrheal Diseases (Enteric, Filth Fly)	Critical	Likely	High
Rabies	Critical	Occasional	High

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. In addition, although not specifically assessed in this document, significant outbreaks of viral gastroenteritis (e.g., norovirus) and food poisoning (e.g., *Bacillus cereus*, *Clostridium perfringens*, *Staphylococcus* spp.) may occur. Key disease threats are summarized below.

A 2019 tactical kitchen inspection report in DOEHS indicated that food is procured from a local market that had not been approved as a food source. To help mitigate risk, the food was noted as being thoroughly washed and fully cooked prior to being served.

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

6.1.1 Diarrheal diseases

Diarrheal diseases are expected to temporarily incapacitate a very high percentage of personnel (potentially over 50% per month) within days if local food, water, or ice is consumed. Mitigation strategies in place include consumption of approved food, water, and ice; hand washing; and applied

food/water safety mechanisms. Field conditions (including lack of hand washing and primitive sanitation) may facilitate person-to-person spread and epidemics. Typically diarrheal diseases are a mild disease treated in an outpatient setting with recovery and return to duty in less than 72 hours with appropriate therapy. A small proportion of infections may require greater than 72 hours limited duty, or hospitalization.

6.2 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.

6.2.1 Leishmaniasis

The disease risk is higher during the warmer months when sandflies are most prevalent, but reduced with mitigation measures. Mitigation strategies in place include IPM practices, permethrin treated uniforms, pesticides, reduction of pest/breeding habitats, and engineering controls. Leishmaniasis is transmitted by sand flies. A small number of cases (less than 1% per month attack rate) could occur among personnel exposed to sandfly bites in areas with infected people, rodents, dogs, or other reservoir animals. In groups of personnel exposed to heavily infected sandflies in focal areas, attack rates can be very high (over 50%). There are two forms of the disease; cutaneous (acute form) and visceral (a more latent form of the disease). The leishmaniasis parasites may survive for years in infected individuals and this infection may go unrecognized by physicians in the U.S. when infections become symptomatic years later. Cutaneous infection is unlikely to be debilitating, though lesions may be disfiguring. Visceral leishmaniasis disease can cause severe febrile illness which typically requires hospitalization with convalescence over 7 days.

6.2.2 Crimean-Congo hemorrhagic fever

Unmitigated risk is present but is reduced with mitigation measures. Crimean-Congo hemorrhagic fever occurs in rare cases (less than 0.1% per month attack rate in indigenous personnel) and is transmitted by tick bites or occupational contact with blood or secretions from infected animals. The disease typically requires intensive care with fatality rates from 5% to 50%.

6.2.3 Sandfly fever

Sandfly fever poses a risk with potential disease rates from 1% to 10% per month; under worst case conditions disease rates can be as high as 50%. Mitigation measures (IPM practices, permethrin treated uniforms, pesticides, reduction of pest/breeding habitats, and engineering controls) reduce the risk. The disease is transmitted by sandflies and occurs more commonly in children though adults are still at risk. Sandfly fever disease typically results in debilitating febrile illness requiring 1 to 7 days of supportive care followed by return to duty.

6.3 Water Contact Diseases

Operations or activities that involve extensive water contact may result in personnel being temporarily debilitated with leptospirosis in some locations. Leptospirosis health 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 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 potentially debilitating skin conditions such as bacterial or fungal dermatitis. Mitigation strategies were in place and included avoiding water contact and recreational water activities, proper wear of uniform (especially footwear), and protective coverings for cuts/abraded skin.

6.3.1 Leptospirosis

Human infections occur seasonally (typically April through November) through exposure to water or soil contaminated by infected animals and is associated with wading, and swimming in contaminated, untreated open water. The occurrence of flooding after heavy rainfall facilitates the spread of the organism because as water saturates the environment *Leptospira* present in the soil passes directly into surface waters. *Leptospira* can enter the body through cut or abraded skin, mucous membranes, and conjunctivae. Infection may also occur from ingestion of contaminated water. The acute, generalized illness associated with infection may mimic other tropical diseases (for example, dengue fever, malaria, and typhus), and common symptoms include fever, chills, myalgia, nausea, diarrhea, cough, and conjunctival suffusion. Manifestations of severe disease can include jaundice, renal failure, hemorrhage, pneumonitis, and hemodynamic collapse. Recreational activities involving extensive water contact may result in personnel being temporarily debilitated with leptospirosis. Incidence could result in debilitating febrile illness typically requiring 1 to 7 days of inpatient care, followed by return to duty; some cases may require prolonged convalescence. Mitigation strategies in place include avoiding water contact and recreational water activities; proper wear of uniform, especially footwear, and protective coverings for cuts/abraded skin.

6.3.2 Schistosomiasis

Humans are the principal reservoir for schistosomes; humans shed schistosome eggs in urine or feces. Animals such as cattle and water buffalo may also be significant reservoirs. Rare cases (less than 0.1% per month attack rate) may occur seasonally (typically April through November) among personnel wading or swimming in lakes, streams, or irrigated fields which were frequently contaminated with human and animal waste containing schistosome eggs. In groups with prolonged exposure to heavily contaminated foci, attack rates may exceed 10%. Exceptionally heavy concentrations of schistosomes may occur in discrete foci, which were difficult to distinguish from less contaminated areas. In non-immune personnel exposed to such foci, rates of acute schistosomiasis may be over 50%. Mild infections are generally asymptomatic. In very heavy acute infections, a febrile illness (acute schistosomiasis) may occur, especially with *Schistosoma japonicum* and *S. mansoni*, requiring hospitalization and convalescence over 7 days.

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, measles, 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 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 PPE when necessary for healthcare providers and detention facility personnel.

6.4.1 Middle East respiratory syndrome coronavirus (MERS-CoV)

Although no cases have been reported in Service members deployed to Syria, Middle East respiratory syndrome coronavirus (MERS-CoV) is known to occur within the region. Most MERS patients developed severe acute respiratory illness with symptoms of fever, cough and shortness of breath. MERS-CoV has spread from ill people to others through close contact, such as caring for or living with an infected person. The incubation period for MERS-CoV is usually about 5 to 6 days, but can range from 2 to 14 days.

6.4.2 COVID-19

According to the CDC website, COVID-19 has an unknown level of transmission in Syria and warns travelers to not visit Syria due to the uncharacterized health risk level. The incubation period for COVID-19 is 3-14 days from exposure. Symptoms can include fever, cough, shortness of breath, fatigue, muscle and body aches, headache, loss of taste or smell, nausea and diarrhea. Several vaccines were available in the U.S. for COVID-19 in 2020, all of which were used to vaccinate US personnel per emergency use authorization.

6.5 Animal-Contact Diseases

6.5.1 Rabies

Rabies poses a year-round risk. Occurrence in local animals was well above U.S. levels due to the lack of organized control programs. Dogs are the primary reservoir of rabies in Afghanistan, and a frequent source of human exposure. 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. A U.S. Army Soldier deployed to Afghanistan from May 2010 to May 2011 died of rabies in New York on 31 August 2011 (Reference 11). Laboratory results indicated the Soldier was infected from contact with a dog while deployed. Although 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, and timely treatment of feral animal scratches/bites.

6.5.2 Q-Fever

Potential health risk to U.S. personnel exists year round but can be mitigated. Rare cases are possible among personnel exposed to aerosols from infected animals, with clusters of cases possible in some situations. Significant outbreaks (affecting 1-50%) can occur in personnel with heavy exposure to barnyards or other areas where animals are kept. Unpasteurized milk may also transmit infection. The primary route of exposure is respiratory, with an infectious dose as low as a single organism. Incidence could result in debilitating febrile illness, sometimes presenting as pneumonia, typically requiring 1 to 7 days of inpatient care followed by return to duty. Mitigation strategies included consuming approved food sources, proper food preparation and cooking temperatures, avoidance of animals and farms, dust abatement when working in these areas, and proper PPE for personnel working with animals.

7 Venomous Animals

All information was taken directly from the Clinical Toxinology Resources web site from the University of Adelaide, Australia (Reference 9). The species listed below have home ranges that overlap the locations of Raqqah and vicinity and may present a health risk if they are encountered by personnel. See Section 10 for more information about pesticides and pest control measures.

7.1 Spiders

- *Latrodectus pallidus*: Clinical effects are uncertain, but related to medically important species, therefore major envenoming cannot be excluded. However, venom effects are mostly minor, followed by progressively severe local pain, though envenoming is unlikely to be lethal.
- *Latrodectus tredecimguttatus*: Severe envenoming is possible, potentially lethal. However, the lethality rate is considered to be 'unlikely'.

7.2 Scorpions

- *Androctonus amoreuxi*, *Androctonus crassicauda*, *Leiurus quinquestriatus*, and *Nebo hierichonticus*: Severe envenoming possible, potentially lethal. Severe envenoming may produce direct or indirect cardio toxicity, with cardiac arrhythmias, cardiac failure. Hypovolemic hypotension possible in severe cases due to fluid loss through vomiting and sweating.
- *Birulatus astartiae*, *Buthacus leptochelys*, *Buthacus macrocentrus*, *Buthacus tadmorensis*, *Buthacus yotvatensis*, *Compsobuthus jordanensis*, *Compsobuthus matthiesseni*, *Compsobuthus wernerii*, *Mesobuthus eupeus*, and *Orthochirus scrobiculous*: 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.
- *Hottentotta judaicus* and *Hottentotta saulcyi*, *Scorpio maurus*: Moderate-mild envenoming possible but unlikely to prove lethal. Stings by these scorpions are likely to cause only short lived local effects, such as pain, without systemic effects.
- *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 *euphratica* and subspecies *obtuse* (Levantine viper), *Montivipera bornmuelleri*: Severe envenoming possible, potentially lethal.
- *Eryx jaculus*: Bite most unlikely to cause fatality, but death from constriction possible, but rare.
- *Malpolon monspessulanus*: Moderate envenoming possible but unlikely to prove lethal.

7.4 Short-term Health Risk

If encountered, effects of venom vary with species from mild localized swelling to potentially lethal effects. See effects of venom above. Mitigation strategies included avoiding contact, proper wear of uniform (especially footwear), and timely medical treatment.

7.5 Long-term Health Risk

None identified.

8 Heat/Cold Stress

The Raqqah area is located approximately 800 feet above sea level. Precipitation is concentrated in the months from late October to late April. Summers are long, hot, windy, and arid, with high humidity in July through late September. Winters are cold, dry, and partly cloudy.

8.1 Heat

Summer (June - September) average daily high temperatures range from 93 degrees Fahrenheit (°F) to 103 °F. The health risk of heat stress/injury based on average high temperatures alone is Low (< 78 °F) from October – April and High (82-103°F) from May – September. 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 is reduced to low through preventive measures such as work/rest cycles, proper hydration and nutrition, and monitoring Wet Bulb Globe Temperature (WBGT). Risk of heat injury in unacclimatized or susceptible populations (older, previous history of heat injury, poor physical condition, underlying medical/health conditions), and those under operational constraints (equipment, PPE, vehicles) is High from May – September and Low from October – April. Confidence in the health risk estimate is low (Reference 4, 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 medium (Reference 4, Table 3-6).

8.2 Cold

8.2.1 Short-term health risks:

Winter (November - March) mean daily minimum temperatures range from 36 °F to 43 °F. 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. 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 medium.

8.2.2 Long-term health risk:

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

9 Noise

9.1 Continuous

Aircraft operations have the potential to cause a significant noise hazard to flight support personnel. Because of the potential noise hazard inherent in flight operations, aviation personnel are required to wear hearing protection and are enrolled in the Hearing Conservation Program. The specific hearing protection used at Raqqah was not specified in the OEHSAs. Noise levels associated with rotary wing aircraft were reported in the 2019 OEHSA as measuring 85-150 A weighted decibels (dBA) at a distance of 100 meters from the airfield source. Exposure durations were not specified. Personnel in close proximity to generators will routinely be exposed to noise though no measurement data were documented.

9.1.1 Short-term health risk:

Low: The short-term risk of noise injury with appropriate hearing protection use is low. No specific continuous noise data was available for individuals. Few exposed personnel (if any) are expected to have noticeable health effects during mission. Confidence in the risk assessment is low (Reference 4, Table 3-6).

9.1.2 Long-term health risk:

Low to moderate: The long-term risk of noise injury with appropriate hearing protection use is low with few exposed personnel (if any) expected to develop delayed onset, irreversible effects. If protective measures are not used, the risk is elevated to moderate and many exposed personnel are plausibly expected to develop delayed onset, irreversible effects. Confidence in risk assessment is low (Reference 4, Table 3-6).

9.2 Impulse

No specific hazard sources were documented in DOEHRS from 2015-2020.

9.2.1 Short and long-term health risks:

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

Contracted personnel perform all waste transport off of Raqqah to unspecified disposal locations. Solid waste is collected in dumpsters and removed every other day. Bags of solid waste were noted as occasionally found on the ground instead of within dumpsters. Hazardous waste is minimal, but when generated, it is transported to Lafarge Cement Factory, Syria for disposition. Wastewater is collected every other day by host nation contractors and disposed off-site. The disposal location was not documented in DOEHRS.

10.3 Fuel/Petroleum Products/Industrial Chemical Spills

No spills were documented in DOEHRS for 2015 – 2020.

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 requires 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 require significant pest management inputs. Use of pesticides targeting against these pests generally involves selection of compounds with low mammalian toxicity and short-term residual using pinpoint rather than broadcast application techniques.

Raqqah: Pest surveillance was not actively performed per the 2019 OEHSA. Pests noted as present include mice, mosquitoes, house and filth flies, scorpions, rats, snakes, and ants. Fly baits and traps were installed where fly populations were observed, typically near trash bins. Cats were noted as present and a potential source of rabies; no additional information was documented in DOEHRS.

10.5 Asbestos

No specific hazard sources were documented in DOEHRS from 2015 – 2020 (Reference 1).

10.6 Lead Based Paint

No specific hazard sources were documented in DOEHRS from 2015 – 2020 (Reference 1).

10.7 Burn Pit and Smoke

Burn pits were not located at Raqqah and vicinity during the 2015 – 2020 timeframe. No local (off-site) burn pits that could affect personnel were identified. The Firebase Raqqah location was noted in the 2018 OEHSA as being away from the city of Ar Raqqah and its industries. No stack emissions (visible smoke) or other smoke source were documented in DOEHRS.

11 References

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

2. Department of Defense (DoD) Instruction 6490.03, *Deployment Health*, 2006 and 2019 revision.
3. DoDI 6055.05, Occupational and Environmental Health, 2008.
4. USAPHC Technical Guide 230, June 2013 Revision.
5. Worldwide Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement at <https://phc.amedd.army.mil/topics/foodwater/ca/Pages/DoDAApprovedFoodSources.aspx>.
6. Modification 13 to United States Central Command Individual Protection and Individual Unit Deployment Policy, 23 March 2017.
7. Modification 14 to United States Central Command Individual Protection and Individual Unit Deployment Policy, 03 October 2019.
8. Modification 15 to United States Central Command Individual Protection and Individual Unit Deployment Policy, 09 April 2020.
9. Clinical Toxinology Resources: <http://www.toxinology.com/>. University of Adelaide, Australia.
10. Goldman RF. 2001. Introduction to heat-related problems in military operations. In: Textbook of military medicine: medical aspects of harsh environments Vol. 1, Pandolf KB, and Burr RE (Eds.), Office of the Surgeon General, Department of the Army, Washington DC.
11. CDC. 2012. Morbidity and Mortality Weekly Report. Imported Human Rabies in a U.S. Army Soldier. May 4, 2012. 61(17); 302-305.
12. Center for Disease Control and Prevention (CDC), Travelers Health, Syria, <https://wwwnc.cdc.gov/travel/destinations/traveler/none/syria>

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/afri/711hpw/usafsam.asp>

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