Military Deployment
Periodic Occupational and Environmental Monitoring Summary (POEMS): Tower 22, Jordan: 2020

AUTHORITY: This periodic occupational and environmental monitoring summary (POEMS) has been developed in accordance with Department of Defense (DoD) Instructions 6490.03 and 6055.05, (References 1-2).

PURPOSE: This POEMS documents the Department of Defense (DoD) assessment of deployment occupational and environmental health (OEH) risk for Tower 22 (TAHA), Jordan. It presents a qualitative summary of health risks identified at this location and their potential medical implications. The report is based on information collected between 1 January 2020 through 31 December 2020 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 Tower 22 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 portions pertaining to environmental sampling are limited to the time period in which samples were collected and information was gathered. This assessment covers the time period of 1 January 2020 through 31 December 2020 however; environmental samples were only collected from January 2020 through November 2020.

The POEMS can be useful to inform healthcare providers and others of environmental conditions experienced by individuals deployed to Tower 22 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 DESCRIPTIONS: Tower 22 is located along the northeast Jordanian border with Syria. Tower 22 has a rural desert environment and a hot and dry climate. Predominate wind direction is from the southeast and annual precipitation averages 20 centimeters in the desert region. Tower 22 has a refugee camp to the northwest of the site towards the Syrian border and shares the east side of the site with the Jordanian Armed Forces (Reference 3).

SUMMARY: Conditions that may have posed a Moderate or greater health risk are summarized in Table 1. Table 2 provides population based risk estimates for identified OEH conditions that may have some level of risk at Tower 22. 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 Tower 22:

For continuous noise exposure, the risk was 'High to Low'; risk may have been reduced by appropriate hearing protection used by personnel in higher risk areas (around sources of continuous noise such as flight lines, generators and power production). For heat stress, risk can be greater during months of May through October, 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 controls, work-rest cycles, proper hydration and nutrition, and mitigation.

Air quality: For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$), the $PM_{2.5}$ overall short-term health risk was "Low." However, the Tower 22 area is a dust-prone desert environment, with a semi-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. 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. According to the OEHSA for CY 2020 a burn pit was operated by the Jordanian Armed Forces at Tower 22; however, the $PM_{2.5}$ overall short-term health risks specifically for burn pits/boxes were not evaluated due to no identified specific environmental samples collected near burn pits/boxes – see Section 10.7. Where burn pits exist, exposures may vary, and exposures to high levels PM 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 PM and/or burn pit/box 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 Tower 22. Personnel who reported with symptoms or required treatment while at site(s) with burn pit/box 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).

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Table 1: Continued

Long-term health risks & medical implications:

The following hazards may be associated with potential chronic health effects in some personnel during deployment at Tower 22:

For continuous noise exposure, the long-term risk was 'High to Low'; risk may have been reduced by appropriate hearing protection used by personnel in higher risk areas (around sources of continuous noise such as flight lines, generators and power production).

Air quality: For inhalable fine particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) from environmental dust (including burn pits), the overall long-term health risk was 'Low'. However, the Tower 22 area is a dust-prone desert environment with a semi-arid climate, also subject to vehicle traffic, and conditions may have varied. According to the OEHSA for CY 2020 a burn pit was operated by the Jordanian Armed Forces at Tower 22; however, the PM overall long-term health risks specifically for burn pits/boxes were not evaluated due to no environmental samples identified as being collected near burn pits/boxes – see Section 10.7. Where burn pits/boxes exist, exposures may vary, as conditions may have varied. For inhalational exposure to high levels of dust containing $PM_{2.5}$, such as during high winds or dust storms, and for exposures to burn pit/box 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 be more likely to develop such chronic health conditions. While the dust and particulate matter exposures and exposures to burn pits/boxes 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, 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).

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Table 2. Population-Based Health Risk Estimates –Tower 22 [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: The short-term health risk was Low for exposure to the ambient air. Because Tower 22 was situated in a dusty rural desert environment, a majority of the time mild acute (short-term) health effects were anticipated; certain peak or elevated levels may have produced mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may have been exacerbated.	Limiting strenuous physical activities when air quality is especially poor; and actions such as closing tent flaps, windows, and doors.	Short-term: The short-term health risk was Low for exposure to the ambient air. Because Tower 22 was situated in a dusty semi-arid environment, a majority of the time mild acute (short-term) health effects were anticipated; certain peak or elevated levels may have produce mild eye, nose, or throat irritation in some personnel and pre-existing health conditions (e.g., asthma, or cardiopulmonary diseases) may have been exacerbated.
	Long-term: The long-term health risk was Low for exposure to the ambient air. A small percentage of personnel may have been 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 long-term health risk was Low for exposure to the ambient air. A small percentage of personnel may have been at increased risk for developing chronic conditions, particularly those more susceptible (e.g., those with asthma/pre-existing respiratory diseases).
Airborne Metals	Short-term: Not an identified source of health risk based on the available data. No metals were detected in any of the samples.		Short-term: Not an identified source of health risk based on the available data. No metals were detected in any of the samples.
	Long-term: Not an identified source of health risk based on the available data. No metals were detected in any of the samples.		Long-term: Not an identified source of health risk based on the available data. No metals were detected in any of the samples.
Volatile Organic Compounds (VOC)	Short-term: No data available		Short-term: No data available
	Long-term: No data available		Long-term: No data available
MILITARY UNIQUE			
Non-ionizing Radiation	Short-term: Tower 22 had an air force radar. The amount of radiation emitted was unknown.	Radar is pointed above and away from the facility to mitigate exposure risk.	Short-term: Tower 22 had an air force radar. The amount of radiation emitted was unknown.
	Long-term: Tower 22 had an air force radar. The amount of radiation emitted was unknown.		Long-term: Tower 22 had an air force radar. The amount of radiation emitted was unknown.
ENDEMIC DISEASE			

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Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
Food borne/ Waterborne (e.g.,diarrhea-bacteriological) Arthropod Vector Borne Water-Contact (e.g., wading, swimming) Respiratory Animal Contact Aerosolized Dust or Soil-contact	Risk levels are no longer provided in Section 6 (Endemic Diseases) for each endemic disease since the National Center for Medical Intelligence (NCMI) website is no longer being updated. The CY 2020 OEHSA provided risk levels for particular endemic diseases; however, it is not specified how the risk levels were obtained. Although risk levels are no longer provided by NCMI, country specific endemic diseases from the CDC can be found in Section 6.	**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 (NCMI) website is no longer being updated. The CY 2020 OEHSA provided risk levels for particular endemic diseases; however, it is not specified how the risk levels were obtained. Although risk levels are no longer provided by NCMI, country specific endemic diseases from the CDC can be found in Section 6.
VENOMOUS ANIMAL/INSECTS			
Snakes, scorpions, and spiders	Short-term: Low; If encountered, effects of venom vary with species from mild symptoms (e.g., *Latrodectus tredeximguttatus*) to potentially lethal effects (e.g., *Atractaspis engaddensis*).	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., *Latrodectus tredeximguttatus*) to potentially lethal effects (e.g., *Atractaspis engaddensis*).
	Long-term: None identified		Long-term: None identified
HEAT/COLD STRESS			
Heat	Short-term: Variable; Risk of heat injury was Extremely High (July and August), High (June and September), Moderate (May and October), and Low (November-April).	Work-rest cycles, proper hydration and nutrition, and Wet Bulb Globe Temperature (WBGT) monitoring.	Short-term: Variable; Risk of heat injury was Extremely High (July and August), High (June and September), Moderate (May and October), and Low (November-April).
	Long-term: Low; However, the risk may have been 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; However, the risk may have been 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. Temperatures rarely dropped below freezing.	Risks from cold stress could have been 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. Temperatures rarely dropped below freezing.
	Long-term: Low; Long-term health implications from cold injuries are rare but could have occurred, especially from more serious injuries such as frostbite.		Long-term: Low; Long-term health implications from cold injuries are rare but could have occurred, especially from more serious injuries such as frostbite.
NOISE			
Continuous (Helipads and Generators)	Short-term: High to Low; High risk to individuals working near major		Short-term: Low risk to personnel working near major noise sources

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Source of Identified Health Risk[3]	Unmitigated Health Risk Estimate[4]	Control Measures Implemented	Residual Health Risk Estimate[4]
	noise sources without proper hearing protection.	Hearing protection was used by personnel in higher risk areas.	who use proper hearing protection.
	Long-term: High to Low; High risk to individuals working near major noise sources without proper hearing protection.		Long-term: Low risk to personnel working near major noise sources who use proper hearing protection.
Unique Incidents/Concerns			
Pesticides/Pest Control	Short-term: Low. Filth flies and mosquitos were identified as an issue but preventative measure were taken. Wild feral dogs were also a concern.	Pest management was handled by a contractor in accordance with performance work standards and included trapping.	Short-term: Low. Filth flies and mosquitos were identified as an issue but preventative measure were taken. Wild feral dogs were also a concern.
	Long-term Low. Filth flies and mosquitos were identified as an issue but preventative measure were taken. Wild feral dogs were also a concern.		Long-term: Low. Filth flies and mosquitos were identified as an issue but preventative measure were taken. Wild feral dogs were also a concern.
Burn pits/Incinerators	According to the OEHSA, the east side of Tower 22 was shared with the Jordanian Armed Forces which operated a burn pit for solid waste disposal. No specific data was available to assess risks - see Section 10.7.	Risks may have been reduced by limiting strenuous physical activities when air quality was especially poor; and taking actions such as closing tent flaps, windows, and doors.	According to the OEHSA, the east side of Tower 22 was shared with the Jordanian Armed Forces which operated a burn pit for solid waste disposal. No specific data was available to assess risk – see Section 10.7

[1]This Summary Table provides a qualitative estimate of population-based short- and long-term health risks associated with the occupational environment conditions at Tower 22. 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 2020 through 31 December 2020. Sampling locations are assumed to be representative of exposure points for the 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 lists those sub-categories specifically identified and addressed at Tower 22. 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).. 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.

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1 Discussion of Health Risks at Tower 22 by Source

The following sections provide additional information about the deployment 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 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

Tower 22 was situated in a rural desert environment. Inhalation of high levels of dust and particulate matter, such as during high winds or dust storms, may have resulted 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) were at greater risk of developing notable health effects.

According to the OEHSA survey report for calendar year (CY) 2020 air pollution sources identified on Tower 22 included a small arms firing range located to the north of the camp, a small scale motor pool, refueling operations for air and ground support, welding operations, generators, and an airfield with four helipads. The CY 2020 OEHSA indicated that a burn pit for solid waste was utilized by the Jordanian Armed Forces to the east of Tower 22 and outside the fenceline. Volatile Organic and Semivolatile Organic chemicals (VOC's and SVOCs) or other chemicals that may be present resulting from a burn pit were not characterized.

2.2 Particulate Matter

Particulate matter (PM) is a complex mixture of extremely small particles suspended in the air. PM includes solid particles and liquid droplets emitted directly into the air by sources such as: power plants, motor vehicles, aircraft, generators, construction activities, fires, and natural windblown dust. 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. PM composition and particle size vary considerably depending on the source. Generally, PM of health concern is fine particles less than 2.5 micrometers ($PM_{2.5}$), which can reach the deepest regions of the lungs when inhaled. Exposure to excessive $PM_{2.5}$ is linked to a variety of potential health effects (Reference 5).

2.3 Particulate Matter, Less Than 2.5 Microns ($PM_{2.5}$)

2.3.1 Exposure guidelines:

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

- Negligible MEG = 65
- Marginal MEG = 250

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

- Negligible MEG = 15
- Marginal MEG = 65

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- Critical MEG = 500

2.3.2 Sample data/notes:

A total of four valid and one invalid $PM_{2.5}$ air samples were collected in CY 2020. All samples were collected in locations frequented by the general population of Tower 22 and therefore were considered to represent the ambient air exposure pathway. The valid samples were collected in January, March, May, and July. The range of 24-hour $PM_{2.5}$ concentrations was 41 $\mu g/m^3$ – 92 $\mu g/m^3$ in CY 2020 with an average concentration of 53 $\mu g/m^3$.

2.3.3 Short-term health risks:

Low: The following health risk determinations were made for typical (estimated using the arithmetic mean) and peak $PM_{2.5}$ sample concentrations. The reported risk levels were determined using the hazard severity (estimated from the possible health effects resulting from exposure at those concentrations) and the hazard probability (or likelihood of those health effects occurring). After determining both of these variables, the risk level was selected using Table 3-1 in Reference 4.

There was no short-term health risk from typical $PM_{2.5}$ exposure because the arithmetic mean (53 $\mu g/m^3$) was below the Negligible MEG (65 $\mu g/m^3$).

The short-term health risk was estimated to be Low based on the peak concentration of 92 $\mu g/m^3$ which was collected in July 2020. For exposures at this peak concentration, the hazard severity was Negligible because the concentration was between 65 $\mu g/m^3$ and 250 $\mu g/m^3$. For exposures at this severity level, a few personnel may have experienced notable eye, nose, and throat irritation but most personnel will have experienced only mild effects. Those with a history of pre-existing health conditions such as asthma or cardiopulmonary diseases may have experienced increased symptoms (Reference 4, Table 3-5). At peak concentration, these effects may have occurred and the hazard probability chosen was Unlikely (Reference 4, Table 3-5). The resulting risk level was estimated to be Low. Confidence in the short-term $PM_{2.5}$ health risk assessment was Low based on the limited number of samples and the distribution of samples collected (Reference 4, Table 3-6).

2.3.4 Long-term health risks:

Low: Prior to the long-term health risk assessment, the quantity and quality of the data was analyzed to determine if sufficient data was available to perform the assessment. It was determined that there was enough samples to perform an assessment as samples were collected during every season but Fall (one each in January, March, May, and July). The long-term health risk from continuous exposure to $PM_{2.5}$ is Low. The hazard severity was determined to be Negligible because the arithmetic mean concentration of 53 $\mu g/m^3$ was between 15 $\mu g/m^3$ and 65 $\mu g/m^3$. At the Negligible severity level, it's possible that a small percentage of personnel may have an increased risk for developing chronic conditions, such as reduced lung function or exacerbated chronic bronchitis, chronic obstructive pulmonary disease (COPD), asthma, arteriosclerosis, or other cardiopulmonary diseases. Personnel with a history of asthma or cardiopulmonary disease are considered to be at particular risk (Reference 4, Table 3-12). The effects resulting from this level of exposure are expected to occur infrequently and the likelihood chosen was Seldom (Reference 4, Table 3-5). The resulting risk level was estimated to be Low. Confidence in the risk estimate is Low based on the small sample size (Reference 4, Table 3-6).

2.4 Airborne Metals

2.4.1 Sample data/notes:

Four valid $PM_{2.5}$ airborne samples were collected for metal analyses at Tower 22 in CY2020. No metals were detected in any of the samples.

2.4.2 Short- and long-term health risks:

None identified based on the available sampling data. No metals were detected in any of the samples.

2.5 Volatile Organic Compounds (VOC)

2.6.1 Sample data/notes:

No VOC air samples were available for Tower 22 for CY 2020.

2.6.2 Short-term and long-term health risks:

Data was not available to evaluate a short or long-term health risk.

3 Soil

3.1 Sample Data/Notes:

No soil samples were available for Tower 22 in CY 2020.

3.2 Short-Term and Long-Term Health Risk:

Data was not available to evaluate a short or long-term health risk.

4 Water

In order to assess the health risk to United States (U.S.) personnel from exposure to water in theater, the Army Public Health Center (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. The exposure pathways identified were untreated source water, and treated water through Reverse Osmosis Water Purification (ROWPU). There was one untreated water sample taken and two treated ROWPU water samples taken in CY 2020. Based on information provided with the sample field data sheets (FDSs) the untreated water was a treatment source and was not used for consumption. Therefore, untreated samples are not assessed as potential ingestion health hazards. The 2020 OEHSA indicated that bottled water was the primary source of drinking water.

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4.1 Drinking Water: Bottled and Packaged Water

4.1.1 Site-specific sources identified:

The 2020 OEHSAs for Tower 22 indicated that the bottled water brand was Aquafina®. Identification of a trademarked product does not imply endorsement by the Army. There were no bottled water samples available to evaluate.

4.1.2 Short-term and long-term health risk:

No available sample data available to determine a health risk.

4.2 Treated Water

4.2.1 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 or swimming.

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 although FDSs indicates a rotation of approximately 9 months. 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 were not used. Two non-drinking water ROWPU samples were evaluated for this health risk assessment. No short or long-term MEGs were exceeded for either of the samples.

4.2.3 Short and long-term health risks:

None identified based on available sample data. No health risks from treated water exposures were identified based on the available 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 DOEHRS for CY 2020 (Reference 3).

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5.2 Depleted Uranium (DU):

No specific hazard sources were documented in the DOEHRS doe CY 2020 (Reference 3).

5.3 Ionizing Radiation:

No specific hazard sources were documented in the DOEHRS for CY 2020 (Reference 3).

5.4 Non-Ionizing Radiation:

Air Force radar TPS-75 was a source of non-ionizing radiation. There was no information on how much non-ionizing radiation was emitted. Radar was pointed above and away from Tower-22 to mitigate any potential exposure risk (Reference 3).

6 Endemic Diseases

This document lists the endemic diseases reported in the region found on the Centers for Disease Control and Prevention (CDC) website (Reference 6). This information was obtained in February 2022 and may not reflect the endemic diseases during the time frame of this POEMS as it was not possible to obtain information from CY 2020 from the CDC website. CENTCOM Modification (MOD) 15 lists deployment requirements, to include immunizations and chemoprophylaxis, in effect during the timeframe of this POEMS (Reference 7). Additionally, some information was provided under the disease threats section in the CY 2020 OEHSA for Tower 22. Information from the OEHSA is summarized in Table 3 below (Reference 3).

Table 3. OEHSA based Disease Threat Assessment at Tower 22

Disease Threat	Hazard Severity	Hazard Probability	Risk Estimate
Sand Fly Fever	Marginal	Seldom	Low
West Nile Fever (WN)	Marginal	Seldom	Low
Rabies	Critical	Unlikely	Low
Sinbis Virus	Marginal	Seldom	Low

6.1 Foodborne and Waterborne Diseases

Foodborne and waterborne diseases in the area could have been transmitted through the consumption of local food and water. Local unapproved food and water sources (including ice) can be heavily contaminated with pathogenic bacteria, parasites, and viruses to which most U.S. Service Members have little or no natural immunity. Ingesting local food and water can temporarily incapacitate personnel (diarrhea) or result in prolonged illness (hepatitis A, typhoid/paratyphoid fever). Risks from food/waterborne diseases may have been reduced with preventive medicine controls and mitigation, which includes vaccinations and only drinking from approved water sources in accordance with standing CENTCOM policy.

6.1.1 Diarrheal diseases (bacteriological):

Diarrheal diseases could temporarily incapacitate a very high percentage of personnel within days if local food, water, or ice is consumed. Field conditions (including lack of hand washing and primitive sanitation) may facilitate person-to-person spread and epidemics. Typically mild disease can be treated in an outpatient setting; with recovery and return to duty in less than 72 hours. A small proportion of infections may require greater than 72 hours limited duty, or hospitalization.

6.1.2 Hepatitis A virus (HAV), and typhoid/paratyphoid fever:

HAV and typhoid/paratyphoid fever may cause prolonged illness in a small percentage of unvaccinated personnel. HAV is transmitted through direct person to person contact or through ingestion of contaminated food or water. HAV can survive in the environment for prolonged periods of time and it can be transmitted through ice and frozen foods. Individuals are most infectious 1-2 weeks before the onset of clinical signs and symptoms. Typhoid and paratyphoid fever are acquired through consumption of water or food contaminated by feces of an acutely infected person. HAV and typhoid can be prevented through immunization (Reference 6).

6.2 Arthropod Vector-Borne Diseases

During the warmer months, the climate and ecological habitat in Jordan supports populations of arthropod vectors, including mosquitoes and flies. Significant disease transmission is sustained countrywide, including urban areas. Mitigation strategies included use of insect repellents. Pest management was performed under contract (Reference 3).

6.2.1 Leishmaniasis/sand fly fever:

Leishmaniasis and sand fly fever is transmitted through the bites of infected sand flies. There are two forms of leishmaniasis; cutaneous (acute form) and visceral (a more latent form of the disease). The most common symptom of cutaneous leishmaniasis is skin lesions that can change in size and appearance over time. The symptoms of visceral leishmaniasis are fever, weight loss, enlarged spleen and liver, and low red blood cell count, platelet count and white blood cell count. Some people may have no symptoms. There is no vaccine for leishmaniasis so personnel must protect themselves using permethrin-treated clothing and insect repellent (Reference 6).

6.2.2 Yellow fever:

Yellow fever is a disease caused by a virus that is spread through mosquito bites. Symptoms appear 3-6 days after infection and include fever, chills, headache, backache, and muscle aches. About 15% of people who get yellow fever develop serious illness that can lead to bleeding, shock, organ failure and sometimes death (Reference 6).

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 is a disease caused by bacteria that

infected animals spread through their urine. Some people with leptospirosis will not have symptoms. When symptoms do occur, they can include fever, headache, chills, muscle aches, vomiting, jaundice, red eyes, stomach pain, diarrhea, and sometimes a rash. Without antibiotic treatment kidney and liver damage may occur. There is no vaccine approved in the U.S. to prevent leptospirosis. Prevention includes avoiding touching water or soil that has the potential to be contaminated and wearing footwear and other protective clothing (Reference 6).

6.4 Respiratory Diseases

Deployed U.S. Forces may have been 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. COVID-19 and Influenza were of particular concern because of their ability to debilitate large numbers of unvaccinated personnel for several days. Mitigation strategies 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. Respiratory infections identified by the CDC to be of particular concern in Jordan are discussed below.

6.4.1 Tuberculosis (TB):

TB is a disease caused by bacteria that is spread in the air to others when coughing, speaking or singing. TB bacteria in the lungs can move through the blood to infect other parts of the body, such as the kidney, spine, and brain. Symptoms of TB disease in the lungs include a cough, pain, weakness, weight loss, chills, fever, and night sweats. Although a TB vaccine does exist it is not always recommended due to its variable effectiveness (Reference 6).

6.4.2 Coronavirus disease 2019 (COVID-19):

According to the CDC website COVID-19 has a very high level (red warning) of infection in Jordan. Symptoms can include fever, cough, shortness of breath, fatigue, muscle and body aches, headache, loss of taste or smell, nausea and diarrhea. Several effective vaccines are currently available to help prevent COVID-19 (Reference 6).

6.4.3 Hantavirus:

Hantavirus is spread through the air or by eating food contaminated with urine or droppings from rodents. Hantavirus can cause organ damage, especially to the kidneys and blood vessels. Complete recovery can take weeks to months. Symptoms of hantavirus usually develop 3 to 4 weeks after infection but can occur as early as 1 week. Symptoms can include fatigue, fever, muscle aches, headaches, dizziness, chills, nausea, vomiting, diarrhea, and abdominal pain. There are no vaccines to prevent hantavirus disease but personnel can protect themselves by avoiding rodents while in Jordan (Reference 6).

6.4.4 Middle east respiratory syndrome (MERS):

MERS is caused by the virus MERS-CoV. Scientists do not fully understand how the virus spreads but

it is likely that it is transmitted through respiratory droplets from coughs or sneezes. It is also believed that touching or being around camels or their bodily fluids may make a person more likely to get MERS. Common symptoms include fever, cough, and shortness of breath. There is no vaccine to prevent MERS so mitigation steps such as washing hands and avoiding close contact with those that are sick are important (Reference 6).

6.4.5 Measles

Measles is a disease caused by a highly contagious virus. Measles is spread through the air through coughs, sneezes and breathe. Symptoms include a rash, high fever, cough, runny nose, and red, watery eyes. Some people who become sick with measles also get a serious lung infection, such as pneumonia. Personnel can prevent measles by getting vaccinated (Reference 6).

6.5 Animal-Contact Diseases

6.5.1 Rabies:

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. In the U.S. rabies mainly occurs in wild animals; however, in Jordan bites from dogs are the main source of rabies. Rabies affects the central nervous system. Without appropriate medical care, rabies causes brain disease and death. Symptoms include weakness or discomfort, fever, and headache. As time progresses an infected person may become delirious, hallucinate and become unable to swallow. A vaccine is available in the U.S. to prevent rabies (Reference 6).

6.6 Soil-Transmitted Helminths (ascaris, whipworm, hookworm)

Soil-transmitted helminths (ascaris, whipworm, and hookworm) refer to the intestinal worms infecting humans that are transmitted through contaminated soil. Helminths live in the intestine and their eggs are passed in the feces of infected persons. Ascaris and whipworm can also be transmitted by hand to mouth when hands are infected with contaminated dirt or by consuming vegetables or fruits that have not been cooked or washed. Heavy infections cause abdominal pain, diarrhea, blood and protein loss, and rectal prolapse. Soil-transmitted helminth infections are treatable with medication prescribed by a health care provider (Reference 6)

7 Venomous Animal/Insect

All information was taken directly from the Clinical Toxinology Resources web site from the University of Adelaide, Australia (Reference 8). This information was obtained in February 2022 and may not reflect the venomous animals/insects during the time frame of this POEMS as it was not possible to obtain information from CY 2020. The venomous species listed below have home ranges that overlapped the location of Tower 22, and may present a health risk if they are encountered by personnel. See Section 10.5 for more information about pesticides and pest control measures.

7.1 Spiders

- *Latrodectus pallidus:* Clinical effects are uncertain but major envenoming cannot be excluded. General symptoms may include headache, arthralgias, tremors, psychosis, severe trismus, dysuria, and dyspnea.

- *Latrodectus tredecimguttatus*: Severe envenoming possible, potentially lethal. However, venom effects are mostly minor and even significant envenoming is unlikely to be lethal. May cause headache, arthralgias, tremors, psychosis, severe trismus, dysuria, and dyspnea.

- *Loxosceles rufescens:* Severe envenoming is possible, potentially lethal. One major effect of envenoming is progressive local necrosis. Systemic effects can include fever, malaise, rash, thrombocytopenia, renal failure and shock.

7.2 Scorpions

- *Androctonus amoreuxi,* and *Androctonus crassicauda*: Severe envenoming possible, potentially lethal. Severe envenoming may produce direct or indirect cardiotoxicity, with cardiac arrhythmias and cardiac failure. Hypovolemic hypotension is possible in severe cases due to fluid loss through vomiting and sweating.

- *Leiurus jordanensis and Leiurus quinquestriatus:* Severe envenoming possible, potentially lethal. Cardiotoxicity is a major clinical effect. Systemic effects may include headache, nausea, vomiting, abdominal pain, diarrhea, tachypnea, respiratory distress, hypotension, dizziness, collapse and convulsions.

- *Nebo hierichonticus:* Severe envenoming possible, potentially lethal. Fatal toxic myocarditis is possible.

7.3 Snakes

- *Atractaspis engaddensis*: Severe envenoming possible, potentially lethal. Indirect cardiotoxicity due to endothelin-like activity, liver damage, as well as blistering, necrosis, headache, nausea, vomiting, abdominal pain, dizziness and convulsions.

- *Cerastes cerastes, Cerastes gasperettii and Cerastes vipera*: Envenoming cannot be excluded. Shock, mild to moderate coagulopathy, and local tissue injury is possible.

- *Daboia palaestinae*: Severe envenoming possible, potentially lethal. Shock secondary to fluid shifts due to local tissue injury. Systemic effects may include headache, nausea, vomiting, abdominal pain, tachypnea, respiratory distress, hypotension, dizziness and convulsions.

- *Echis coloratus:* Severe envenoming possible, potentially lethal. Local necrosis can be moderate to severe. Coagulopathy and hemorrhages are common as well as renal damage and shock.

- *Macrovipera lebetina* (Levantine Viper)*,* and *Macrovipera lebetina turanica* (Levantine Viper):

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Severe envenoming possible, potentially lethal. Moderate to severe coagulopathy and hemorrhages causing extensive bleeding is common. Renal damage and shock is also possible.

- *Malpolon monspessulanus:* Moderate envenoming possible but unlikely to prove lethal. General systemic effects are variable but may include headache, nausea, vomiting, abdominal pain, dizziness or convulsions.

- *Walterinnesia aegyptia*: Potential lethal envenoming is possible but is unlikely. Possible postsynaptic neurotoxin with systemic effects may include headache, nausea, vomiting and fever.

7.4 Short-term health risk:

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

7.5 Long-term health risk:

No long-term health effects were identified with proper treatment.

8 Heat/Cold Stress

8.1 Heat

Jordan has an average daily high temperature above 82 degrees Fahrenheit (°F) from May through October based on historic climatological data (Reference 9). However, work intensity and clothing/equipment worn could have posed a greater health risk of heat stress/injury than environmental factors alone (Reference 10). Managing risk of hot weather operations likely 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 likely reduced with preventive measures.

8.1.1 Short-term health risk:

Variable: Based on standard Army policy the risk of heat injury should have been 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) was Low (< 78 °F) from November-April, Moderate (78-81.9°F) in May and October, High (82-87.9°F) in June and September, and Extremely High (≥ 88°F) in July and August (Reference 9).

8.1.2 Long-term health risk:

Low: The long-term risk was Low. However, the risk may have been 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 have increased long-term health risks, though specific scientific evidence is not conclusive.

8.2 Cold

The cool season for Jordan is from December through March with an average daily high temperature below 63 °F and lows from 42 °F to 47 °F. The coldest month of the year is January, with an average low of 42 °F and a high of 55 °F (Reference 9).

8.2.1 Short-term and long-term health risks:

Low: The short and long-term health risk of cold injury was Low as 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. Any long-term risk is rare but could occur with more serious injuries such as frostbite.

9 Noise

9.1 Continuous:

The helipads at the airfield and generators were identified as sources of noise in the OEHSA for CY 2020 (Reference 3). The helipads located west of the camp were noted to have a noise level greater than 85 decibels. Personnel working around the helipads were required to use personal protective equipment when near the flight line. Generators were not co-located in one central location and were instead placed in various locations around the camp. There was a potential for exposure of personnel who are continually near running generators over an extended period of time to include operators. There were no signs showing "hearing protection required". Motor pool operations could also have posed a threat for general noise exposure (Reference 3).

9.1.1 Short-term and long-term health risks:

High to Low: High to moderate risk for personnel that did not wear hearing protection (dependent on magnitude, frequency and duration of exposures). Low risk for personnel working near major noise sources who wore proper hearing protection.

9.2 Impulse:

No specific hazard sources were documented in DOEHRS for CY 2020.

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

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are used, how long the exposure lasts, 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:

Tower 22 had a contractor (Loyalty Support Services (LSS)) who collected and transported both solid waste and hazardous waste to a landfill at H5, Jordan. No waste was disposed of on Tower 22. The hazardous waste was collected in appropriate containers (POL, flammable, corrosive chemical) and stored for pick up in either the maintenance bay or the dust off maintenance area. Solid waste was collected in dumpsters throughout the facility, then hauled to H5 by garbage trucks maintained by LSS. If waste exceeded the dumpster capacity, there was a connex near the dinning facility for additional storage. LSS was responsible for hazardous waste and solid waste pickup on an as needed basis. If containers became full prior to routine pickup, LSS was notified (Reference 3).

10.3 Fuel/petroleum products/industrial chemical spills

Tower 22 had one 2,000 gallon and one 20,000 gallon JP-8 above ground storage tank, one 2,000 gallon above ground gasoline tank and one 50,000 gallon above ground diesel tank which were contractor operated. Proper spill containment and clean up kits were available and employees were instructed to wear proper PPE. No past releases or spills were documented in the OEHSA (Reference 3)

10.3.1 Short-term and long-term health risks:

None identified: There were no spills identified during the time-frame of this POEMS.

10.4 Lead Based Paint

No specific lead based paint sources were documented in the DOEHRS for CY 2020 (Reference 3).

10.5 Pesticides/Pest Control

The health risk of exposure to pesticide residues was considered within the framework of typical residential exposure scenarios, based on the types of equipment, techniques, and pesticide products that were 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. Specifically, filth flies and mosquitoes were identified as a concern at Tower 22. Flies were controlled through sticky traps. Rats, cats and wild feral dogs were spotted in the area and likely came from nearby refugee camps. Traps were used when necessary. No pesticide application reports were available in the DOEHRS. Pest management was handled by the LSS contractor in accordance with performance work statements (Reference 3).

10.5.1 Short-term and long-term health risks:

Low: Short-term and long-term health risks were Low since preventative measures were available and pests were controlled by a contractor.

10.6 Asbestos

No specific hazard sources were documented in the DOEHRS for CY 2020 for asbestos (Reference 3).

10.7 Burn Pits/Incinerators

The CY 2020 OEHSA indicated that the east side of the facility was shared with the Jordanian Armed Forces which operated a burn pit for solid waste disposal (Reference 3). Prevailing winds are generally from the west April through October. Winds and are much more variable in the winter months (November through March) with there being an eastern flow approximately 30% of the time (Reference 9). There was no additional information regarding the specifics of the burn pit available.

Exposure to burn pit smoke is variable. Exposure to high levels of $PM_{2.5}$ from smoke may have resulted in mild to more serious short-term health 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). Exposure to high levels of PM in the smoke may have also been 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.

While not specific to Tower 22, 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 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 which could also apply to Jordan) 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. 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 U.S. 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

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11. IOM (Institute of Medicine). 2011. Long-term health consequences of exposure to burn pits in Iraq 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).
U.S. Army Public Health Center (USAPHC) Phone: (800) 222-9698. https://phc.amedd.army.mil/Pages/default.aspx
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

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