ENTOMOLOGICAL OPERATIONAL RISK MANAGEMENT

How to Perform an **Entomological Operational Risk Assessment**

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TABLE OF CONTENTS

PAGE

CHAPTER 1 – INTRODUCTION 1
1.1 BACKGROUND 1
1.2 PURPOSE 1
1.3 ENTOMOLOGICAL ORM 1

CHAPTER 2 – HAZARD IDENTIFICATION 3
2.1 IDENTIFY HAZARDS 3
2.2 AFMIC INFECTIOUS DISEASE RISK ASSESSMENT 3
2.3 MEDICAL ENVIRONMENTAL DISEASE INTELLIGENCE AND COUNTERMEASURES CD4
2.4 OTHER INFORMATION SOURCES 5

CHAPTER 3 – HAZARD ASSESSMENT 7
3.1 ASSESS HAZARDS 7
3.2 RISK ASSESSMENT MATRIX 8
3.3 HAZARD SEVERITY ESTIMATE 9
3.4 HAZARD PROBABILITY ESTIMATE 12

CHAPTER 4 – ENTOMOLOGICAL OPERATIONAL RISK ASSESSMENT 19
4.1 EORA FORMAT 19
4.2 EORA EXAMPLE 19

APPENDIX A - REFERENCES A-1

APPENDIX B - EXPECTED DISEASE LEVEL ESTIMATE B-1
B.1 STANDARDIZED METHODOLOGY B-1
B.2 DISEASES AND THE RISK POSED TO U.S. FORCES B-1
B.3 DISEASES OF POTENTIAL MILITARY SIGNIFICANCE B-1
B.4 EXCLUDED DISEASES B-3
B.5 MAXIMUM EXPECTED RATE B-3
B.6 ENDEMICITY B-4
B.7 EXPECTED DISEASE LEVEL IN U.S. FORCES B-5

Page

APPENDIX C - SAMPLE ENTOMOLOGICAL OPERATIONAL RISK ASSESSMENT C-1

APPENDIX D. GLOSSARY D-1
D.1 ACRONYMS D-1
D.2 TERMS AND DEFINITIONS D-2

LIST OF TABLES AND FIGURES

TABLE 1. RISK ASSESSMENT MATRIX 8
TABLE 2. HAZARD SEVERITY MATRIX 10
TABLE 3. EXPECTED DISEASE LEVEL TO HAZARD SEVERITY CONVERSION 11
TABLE 4. HAZARD PROBABILITY MATRIX 12
TABLE B.1 MAXIMUM EXPECTED RATES (MER) B-6
TABLE B.2 EXPECTED DISEASE LEVEL MATRIX B-8

FIGURE 1. ENTOMOLOGICAL HAZARD ASSESSMENT PROCESS 7

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Army risk management doctrine, as detailed in Field Manual (FM) 100-14, provides commanders with methods to evaluate and manage the risks posed by Army operations. Operational risk management (ORM) is a five-step process (that is, identify hazards, assess hazards, develop controls, implement controls, and supervise and evaluate) to conserve combat power and resources. Preventive medicine personnel participate in the ORM process by addressing the risks of occupational and environmental health (OEH) hazards which includes entomological hazards. An Entomological Operational Risk Assessment (EORA) uses the first two steps of the ORM process: identify and assess hazards.

1.2 PURPOSE AND SCOPE

This technical guide (TG) is written for preventive medicine personnel who are responsible for providing health risk management advice to unit commanders and leaders during operational planning to document the EOR process. (See Appendix A for reference information.) It is written to --

a. Assist preventive medicine personnel identify entomological hazards.

b. Guide preventive medicine personnel on how to use the ORM process to assess entomological hazards and determine the Operational Risk Management Estimate of Vector-borne and Zoonotic Diseases.

1.3 ENTOMOLOGICAL ORM

The role of the Army entomologist is to protect soldiers, materials, and facilities from the detrimental effects of insect, animal, and plant pests. During a deployment, this broad mission becomes focused on issues that affect the health of the soldiers and their ability to accomplish their mission. The primary concern is vector-borne disease, or those diseases that are carried by arthropods (such as, mosquitoes, ticks and mites). These vector-borne diseases have posed a significant threat to military forces

throughout history and have been a consistent focus of military preventive medicine. The Army entomologist is also called upon to protect soldiers from zoonotic diseases (such as leptospirosis and hantavirus) carried by vertebrate pests. A list of diseases identified as entomological hazards is presented in Appendix B, Table B.1.

In addition to vector-borne and zoonotic disease, entomological hazards during a deployment also include those hazards associated with biting and stinging arthropods (such as, fire ants, spiders, and scorpions); animals (such as, rodents, birds, bats, and snakes); poisonous plants (such as, oak, and sumac); and pesticide exposure. Biting and stinging arthropods can degrade mission readiness and combat effectiveness even though they are relatively free of vector-borne disease. These arthropods can cause casualties from secondary infections and even death from allergic reactions to their venom. Annoyance from high populations of pests, itching bites, and loss of sleep can also reduce morale. While these "non-disease" entomological hazards can be important in any geographical area and should not be ignored, they are usually not addressed in an EORA. These hazards are considered to be a health threat to individual soldiers but not a medical threat to operations.

CHAPTER 2

HAZARD IDENTIFICATION

2.1 IDENTIFY HAZARDS

The first step in an EORA process is to make a list of the entomological hazards that personnel may face during a deployment. The Armed Forces Medical Intelligence Center (AFMIC) products are the primary source of information on entomological hazards, but these products do not address "non disease" entomological hazards.

2.2 AFMIC INFECTIOUS DISEASE RISK ASSESSMENT

The best source of information from which to prepare a list of entomological hazards is the AFMIC's web-based Infectious Disease Risk Assessment (IDRA). Available at their web site (mic.afmic.detrick.army.mil), the IDRAs have been prepared for each country and are accessed through the respective country's page. Diseases are ranked as "Diseases of Greatest Risk" and "Diseases of Potential Risk" in categories based upon mode of transmission (such as, vector-borne, water-contact, and soil-contact).

Entomological hazards to be addressed in the EORA are identified in the AFMIC IDRA as follows:

a. Vector-borne and zoonotic diseases rated as "Diseases of Greatest Risk."

b. Vector-borne and zoonotic diseases rated as "Diseases of Potential Risk" and have an expected disease level of "Significant number, 2-50 percent per month" or "Low number, up to 1 percent per month."

c. Remaining vector-borne and zoonotic diseases listed as "Diseases of Potential Risk" with an expected disease level of "Sporadic" are normally included in the published EORA as possible hazards but are not included in the risk assessment process. However, if they cause a hazard because of the unique characteristics of the mission, then they should receive a risk assessment. While these diseases pose a health threat to individual soldiers, they are unlikely to be a medical threat to operations.

The preventive medicine person(s) conducting the EORA must check Disease Occurrence - Worldwide (DOWW) on the AFMIC web page for any changes in disease

levels that have occurred since the publication date of the IDRA. Changes in disease occurrence in the local population may prompt changes to the entomological hazard list.

2.3 MEDICAL ENVIRONMENTAL DISEASE INTELLIGENCE AND COUNTERMEASURES CD

If the AFMIC IDRA is not available via their web site, the Medical Environmental Disease Intelligence and Countermeasures (MEDIC) CD can be used to prepare a list of entomological hazards. Follow the same procedure as AFMIC IDRA (discussed in paragraph 2.2) to identify entomological hazards.

a. The MEDIC CD prior to 2002 uses a different format. Organized by country under the heading Infectious Diseases, the IDRA lists diseases in three categories: (1) Short Incubation, (2) Long Incubation, and (3) Other Diseases of Potential Military Significance**.** Entomological hazards to be addressed in the EORA are identified in the MEDIC CD as follows:

(1) All vector-borne and zoonotic diseases listed in either "Short Incubation" or "Long Incubation" categories that have a maximum expected rate (MER) of 1 percent per month or greater (Appendix B, Table B-1).

(2) Any vector-borne and zoonotic diseases listed in either "Short Incubation" or "Long Incubation" categories with an MER less than 1 percent per month should be included if they are determined to be a hazard because of unique characteristics of the mission. Normally, however, these diseases are included in the published EORA as possible hazards but are not included in the risk assessment process. These diseases may pose a health threat to individual soldiers, but they are unlikely to be a medical threat to operations.

(3) All vector-borne and zoonotic diseases listed as "Other Diseases of Potential Military Significance" should be included if they are determined to be a hazard because of the unique characteristics of the mission. Normally, however, these diseases are included in the published EORA as possible hazards but are not included in the risk assessment process. These diseases many pose a health threat to individual soldiers, but they are unlikely to be a medical threat to operations.

b. The MEDIC CD also contains the following information important to identifying other "non-disease" entomological hazards:

(1) Living hazards database in the reference documents section lists hazardous animals and plants by country.

(2) Disease-vector information lists vector species.

2.4. OTHER INFORMATION SOURCES

If AFMIC resources are not available, the list of entomological hazards must be generated from other information sources. The information sources listed in the following paragraphs should be consulted even if the AFMIC information is available. Information from a variety of sources will help gain a complete understanding of the entomological hazards faced by deploying forces—

a. THE DISEASE VECTOR ECOLOGY PROFILES (DVEPs). DVEPS are no longer published in hard copy. They are available at the Armed Forces Pest Management Board (AFPMB) web site (www .afpmb.org.) In addition to Military Important Diseases, DVEPs also include Country Profiles and Noxious/Venomous Animals and Plants of Military Significance

b. DISEASE OUTBREAK INFORMATION. The degree of exposure that the local population may have to the disease pathogen is important in the risk assessment process. Disease rates in the local population will reflect the likelihood of the pathogen exposure to the U.S. Forces. Sources for disease outbreak information include—

(1) AFMIC's DOWW.

(2) ProMed (www. promedmail.org).

(3) Traveler's health web sites. (See below).

c. TRAVELER'S HEALTH WEB SITES. Travel web sites, which provide travel health recommendations, can be a good source of current information about potential entomological hazards and risks for deploying U.S. Forces—

(1) http://www.cdc.gov/travel/

(2) http://travel.state.gov/travel_warnings.html

(3) http://www.fitfortravel.scot.nhs.uk/

(4) http://www.who.int/home-page/

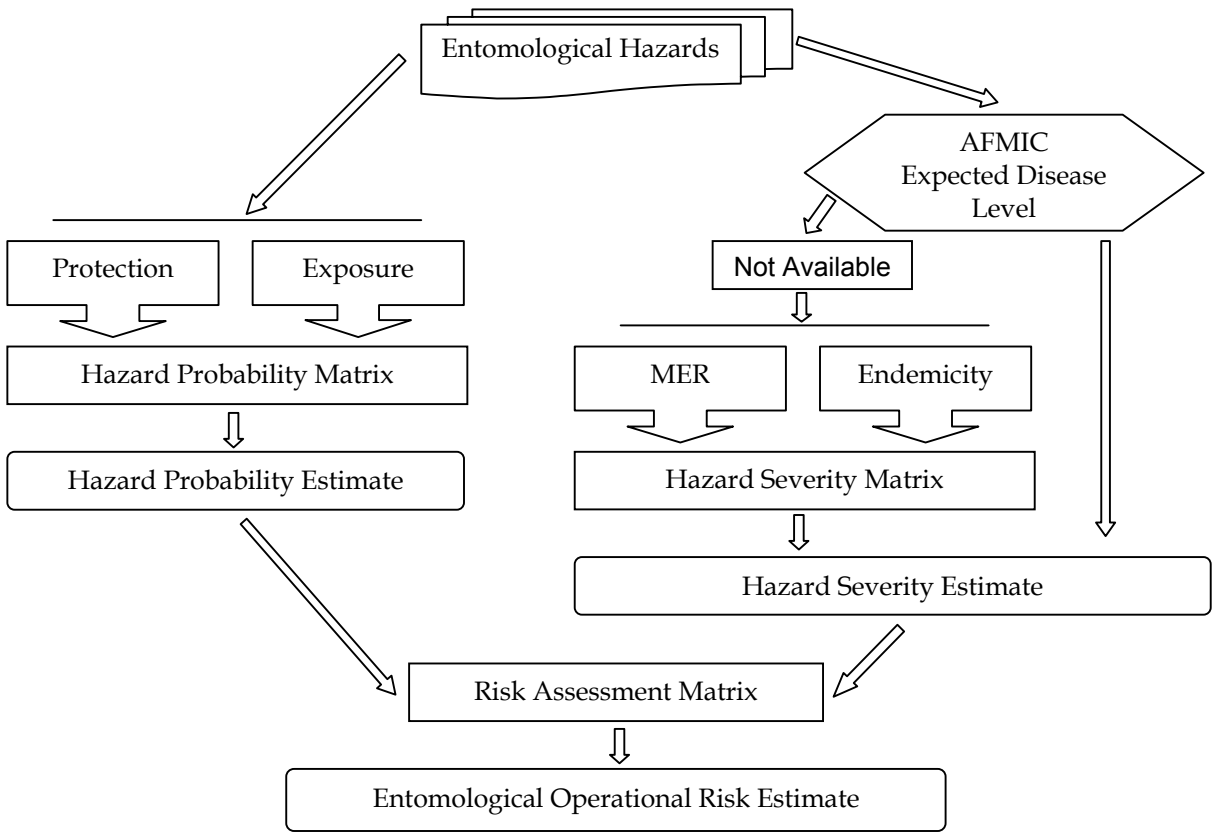
CHAPTER 3

HAZARD ASSESSMENT

3.1 ASSESS HAZARDS

a. The second step in the EORA process is to assess the hazards identified and prepare a risk estimate. The hazard assessment process is presented in Figure 1.

FIGURE 1. ENTOMOLOGICAL HAZARD ASSESSMENT PROCESS



b. The vector borne and zoonotic diseases that make up the entomological hazard are highly variable and hard to predict because many variables interact together. Therefore, four factors (that is, seriousness of the disease, likelihood of disease,

exposure to vectors, and protection measures) are evaluated with the assistance of three matrices to account for this variation. The risk is constantly changing; therefore, any entomological risk estimate only represents a point in time and as a result must be updated on a regular basis.

3.2 RISK ASSESSMENT MATRIX

a. An ORM estimate of vector-borne and zoonotic diseases is established for each of the identified entomological hazards. The Risk Assessment Matrix (Table 1) guides this assessment.

TABLE 1. RISK ASSESSMENT MATRIX

HAZARD SEVERITY		HAZARD PROBABILITY				
		Frequent (A)	Likely (B)	Occasional (C)	Seldom (D)	Unlikely (E)
Catastrophic (I)	→	Extremely High	Extremely High	High	High	Moderate
Critical (II)	→	Extremely High	High	High	Moderate	Low
Marginal (III)	→	High	Moderate	Moderate	Low	Low
Negligible (IV)	→	Moderate	Low	Low	Low	Low
		RISK ESTIMATE				

(Sources: FM 100-14 and USACHPPM TG 248)

b. The risk management estimate is based on the interaction of hazard severity and hazard probability estimates. Each estimate is also based upon the interaction of two factors. The hazard estimate is based upon the interaction of the severity of the disease and the prevalence of the disease in the civilian population (see section 3.3 and Appendix B). The hazard probability estimate is based upon the interaction of the potential exposure of personnel to vectors and/or infectious agents and the effectiveness of force protection measures (see section 3.4).

c. When applying the hazard severity and hazard probability estimates to the ORM, the ORM Estimate can be established based upon the following categories:

(1) EXTREMELY HIGH RISK (BLACK). Expected losses from this entomological hazard will cause the loss of ability to accomplish the mission or mission failure.

(2) HIGH RISK (RED). Expected losses from this entomological hazard will cause significant degradation of mission capabilities in terms of the required mission standard, inability to accomplish all parts of the mission, or inability to complete the mission to standard.

(3) MODERATE RISK (AMBER). Expected losses from this entomological hazard will cause degraded mission capabilities or degraded ability to complete the required mission to standard.

(4) LOW RISK (GREEN). Expected losses from this entomological hazard will have little or no impact on accomplishing the mission.

3.3 HAZARD SEVERITY ESTIMATE

a. HAZARD SEVERITY MATRIX

(1) The hazard severity estimate for the Hazard Severity Axis of the Risk Assessment Matrix is derived from the interaction of the seriousness of the disease and the prevalence of the disease in the civilian population.

(a) MER estimates the seriousness of the disease and its impact on operations. It is important to prioritize the entomological hazards to ensure those with the most impact receive priority in the risk assessment process. MER is a tool to rank and prioritize vector-borne and zoonotic diseases that personnel will face when deployed. MER estimates for diseases identified as entomological hazards are listed in Appendix B, Table B-1.

(b) Endemicity estimates the prevalence of the disease in the civilian population. Endemicity is intended to reflect the likelihood of exposure of the U.S. Force to the disease pathogen.

(3) The Hazard Severity Matrix (Table 2) guides this assessment based on AFMIC methodology for estimating the expected disease level presented in Appendix B.

Table 2. Hazard Severity Matrix

Hazard Severity				
MER	Endemicity			
	Sporadic	Low	Intermediate	High
1/1000	No Hazard	No Hazard	Possible Hazard	Possible Hazard
1%	No Hazard	Possible Hazard	Possible Hazard	Negligible
2-10%	Possible Hazard	Negligible	Negligible	Marginal
11-50%	Possible Hazard	Negligible	Marginal	Critical
> 50%	Negligible	Marginal	Critical	Catastrophic

(3) When applying MER and endemicity estimates to the hazard severity matrix, an estimate of the Hazard Severity is established for each of the identified entomological hazards based upon the following categories:

(a) CATASTROPHIC. At highest exposure levels, more than 50 percent per month of personnel exposed to vectors or pathogen contaminated areas could develop disease.

(b) CRITICAL. At highest exposure levels, 11 – 50 percent per month of personnel exposed to vectors or pathogen contaminated areas could develop disease.

(c) MARGINAL. At highest exposure levels, 2 – 10 percent per month of personnel exposed to vectors or pathogen contaminated areas could develop disease.

(d) NEGLIGIBLE. At highest exposure levels, up to 1 percent per month of personnel exposed to vectors or pathogen contaminated areas could develop disease.

(e) POSSIBLE HAZARD. At highest exposure levels, up to 1 per 1000 per month of personnel exposed to vectors or pathogen contaminated areas could develop disease.

(f) NO HAZARD. At highest exposure levels, personnel exposed to vectors or pathogen contaminated areas are not expected to develop disease.

b. ESTIMATE PREPARATION

(1) AFMIC's expected disease level found in the AFMIC IDRA can be used to estimate the hazard severity. This is the preferred method to obtain the hazard severity estimate because AFMIC has a broader array of resources to use estimating the endemicity. Convert the expected disease level found in the AFMIC IDRA to the corresponding hazard severity rank using Table 3.

TABLE 3. EXPECTED DISEASE LEVEL TO HAZARD SEVERITY CONVERSION

AFMIC EXPECTED DISEASE LEVEL ESTIMATE					
Cases Not Expected	Infrequent/ Sporadic	Small Number	Operationally Significant Number		
	1 per 1000	Up to 1 %	2 - 10 %	11 - 50 %	More than 50 %
HAZARD SEVERITY ESTIMATE					
No Hazard	Possible Hazard	Negligible	Marginal	Critical	Catastrophic

(2) The person conducting the EORA must check the DOWW on the AFMIC web page for any changes in disease levels that have occurred since the publication date of the IDRA to ensure the disease level estimate is still appropriate.

(3) If an expected disease level is not available from AFMIC sources, then the person conducting the EORA assessment must prepare the estimate.

(a) MER estimates for diseases identified as entomological hazards are listed in Appendix B, Table B.1.

(b) Follow the AFMIC methodology presented in Appendix B to estimate endemicity. Sources for local population disease information are presented in Chapter 2, paragraph 2.2. If endemicity cannot be determined with a high degree of confidence, then assume "worst case" situation and use high as the estimate in the endemicity axis of the in the matrix (Table 2).

3.4 HAZARD PROBABILITY ESTIMATE

a. HAZARD PROBABILITY MATRIX

(1) The hazard probability estimate for the Hazard Probability Axis of the Risk Assessment Matrix is based upon the interaction of two factors to obtain an estimate of the probability of transmission of the vector-borne pathogens: the potential exposure of personnel to vectors and/or pathogens; and the effectiveness of force protection measures. This assessment is guided by the hazard probability matrix (Table 3).

TABLE 3. HAZARD PROBABILITY MATRIX

HAZARD PROBABILITY					
FORCE PROTECTION MEASURES	EXPOSURE TO VECTORS OR PATHOGEN (High → Low)				
Low	Frequent	Frequent	Likely	Occasional	Occasional
	Frequent	Likely	Likely	Occasional	Seldom
	Likely	Likely	Occasional	Occasional	Seldom
	Occasional	Occasional	Occasional	Seldom	Unlikely
High	Occasional	Seldom	Seldom	Unlikely	Unlikely

(2) When applying the exposure and force protection estimates to the Hazard Probability Matrix, the Hazard Probability Estimate can be established in the following categories:

(a) FREQUENT. Exposure to hazard (bitten by infected vectors) expected to occur continuously or very often during mission or operation. No force protection measures being used.

(b) LIKELY. Exposure to hazard expected to occur at a high rate but experienced intermittently. Few or ineffective force protection measures being used and poor compliance.

(c) OCCASIONAL. Exposure may occur during a specific mission or operation but not often. Basic force protection measures in use but compliance level sporadic.

(d) SELDOM. Exposure to hazard possible, but not expected to occur during a specific mission or operation. Most force protection measures in use, isolated incidents of non-compliance.

(e) UNLIKELY. Can assume exposure to hazard will not occur but not impossible. Full range of force protection measures in place with good compliance.

b. EXPOSURE ESTIMATE

(1) The exposure estimate is a subjective evaluation of the degree of exposure to vectors or pathogen-contaminated areas. The large number of variables makes it impossible to establish categories. The polygon shape on the exposure axis of the probability matrix represents the continuum that exists from high exposure to low exposure to the hazard. This scale ranges from continuous exposure to bites of pathogen-carrying vectors, contaminated soil, or contaminated water on the high end to no exposure expected on the low end.

(2) The following questions need to be addressed to complete the exposure estimate evaluation:

(a) Will the mission put personnel into close contact with vectors?

- VECTOR HABITS. Exposure to vectors can be affected by the vector's habits. For example, the Malaria vector *Anopheles* mosquitoes are nighttime biters. Nighttime missions in a malaria area will cause exposed personnel to be at a higher risk because the vector is active at night. *Aedes* mosquitoes, on the other hand, are daytime biters

and carry dengue. Therefore, a nighttime mission in a dengue area would be a lower risk. Also, sand flies fly close to the ground. Therefore, a person in a foxhole on guard duty would have a greater risk of leishmannsis than a person walking guard duty because the face and hands are exposed to sand fly bites.

- VECTOR HABITAT. Exposure to vectors will be greater in or near its favorable habitat. Higher tick exposure will occur in forested areas or areas associated with domestic livestock. Swampy areas are generally associated with mosquito breeding and the diseases they carry. Dengue vectors, on the other hand, are container-breeding *Aedes* mosquitoes and found primarily in urban areas.

- BILLETING. Exposure to vectors, contaminated soil, or water will be greatest when the mission requires bivouacking in the fields. Personnel will have less exposure when they are billeted in tents. The least exposure will be when personnel are billeted in buildings with doors and screened windows.

(b) Will conditions during deployment be favorable for disease transmission?

- SEASONALITY. Exposure to vector populations vary by the time of year. Seasonality is most apparent in a temperate climate where exposure to vectors occurs during warmer months because vectors are absent during the winter. In a tropical climate, while vectors are present year round, greater exposure occurs during the rainy season from larger vector populations with greater distribution. For tick vectors, the exposure is seasonal because of its life cycle. Nymphs of *Ixodes scapularis*, (vector of Lyme disease) occur in the spring.

- RECENT WEATHER. Weather conditions have a great affect on vector populations and, therefore, exposure. Generally warmer, wetter weather is favorable for vectors. Rainy weather is generally associated with increased mosquito breeding. However, some situations are counter intuitive; heavy rains followed by dry weather create the organically polluted water favored by *Culex* mosquitoes.

- DENSITY OF VECTOR. The larger the number of vectors the greater the exposure. This exposure factor is not available during predeployment planning; it is determined with surveillance "on the ground" after deployment.

- INFECTION RATE**.** The infection rate of the pathogen in the vector will affect exposure. Larger number of vectors carrying the pathogen will increase the exposure. This exposure factor is not available during predeployment planning; it is determined by testing vectors collected during surveillance conducted "on the ground" after deployment.

(c) What is the Incubation Period? It is the length of time between personnel exposure and onset of symptoms, usually defined as short (<15 days) or long (>15 days) incubation.

(d) What strain/species of the pathogen is present? Some diseases have more than one strain or species of the pathogen that causes the disease. They vary in their pathogenicity and resistance to countermeasures. Of the four *Plasmodium* species that cause malaria, *P. falciparum* is a far more serious than the others and is potentially fatal.

c. PROTECTION ESTIMATE

The protection estimate is a subjective evaluation of the effectiveness of the force protection measures implemented to protect personnel from entomological hazards. The large number of protection measures and the variation in their use make it impossible to establish categories. The polygon shape on the force protection axis of the probability matrix represents the continuum that exists from high to low protection from the hazard. This scale ranges from exposure without force protection measures at the low end to conscientious use of all appropriate force protection measures at the high end.

(1) COMMAND EMPHASIS

We know how to prevent disease. Appropriate countermeasures are common knowledge in the preventive medicine community. Carrying out preventive medicine measures at the unit level is the hard part. Command emphasis is the cornerstone of prevention. Preventive medicine personnel can make recommendations, but only the chain of command can enforce preventive medicine measures. Preventive medicine personnel cannot make troops use a bed net or take their chemoprophylaxis, unit leaders make these things happen.

(2) INDIVIDUAL FORCE PROTECTION

(a) Individual Force Protection Measures include the Department of Defense (DOD) Insect Repellent System, sleeping under treated bed nets, chemoprophylaxis, and vaccination. The DOD Insect Repellent System has three components: DEET (N, N-Diexhyl-meta-toluamide) repellant on skin, battle dress uniform (BDU) treated with Permethrin clothing repellant and proper wearing of the BDU.

(b) The cost is greater than $5,000 to supply a typical infantry company (120 personnel) with "standard load" (FR 700-2) of skin and clothing repellents. Therefore, units are unlikely to have an adequate supply on hand. Items must be purchased at deployment, which means that the unit may not get the repellents in time or the repellents may not be available. (For example, the IDA Kits may not be received in time to treat BDUs prior to deployment).

(c) The following questions need to be addressed to complete the effectiveness of individual force protection estimate evaluation:

- Do units have an adequate supply of DEET repellent? Is it being used during times appropriate to vector exposure?

- Have BDUs been treated with permethrin? Are soldiers wearing treated BDU or other clothing during off-duty hours?

- Are bed nets on hand, issued with poles, and treated with permethrin?

- Have personnel been vaccinated for appropriate vector-borne diseases (such as, Yellow fever or Japanese encephalitis)?

- Has chemoprophylaxis been initiated where there is a malaria or leptospirosis risk? Is the taking of these "meds" supervised?

(3) Unit Force Protection Measures

(a) Unit force protection measures are field sanitation teams (FSTs) and vector control.

(b) Each company-sized unit or equivalent is required to have an FST. FSTs provide unit-level preventive medicine and are responsible for teaching soldiers how to use protective measures, issue skin and clothing repellents and monitor their use, provide timely feed back to the commander regarding compliance, and coordinate with Division or Corps preventive medicine assets. In the absence of an operational FST, it is unlikely that most units will adequately emphasize the soldier's use of personal protection measures until the mission is compromised or until the soldiers get sick.

(c) Vector surveillance and control is performed by a preventive medicine detachment. Vector control with pesticide spraying is generally impractical or ineffective in many combat or other field settings involving rapid troop movements. Although insecticide application can be used in fixed-base military operations despite its cost, time demands, and potential hazards, it is difficult to achieve arthropod control in a field setting.

(d) The following questions need to be addressed to complete the effectiveness of unit force portion of the protection estimate evaluation:

- UNIT FIELD SANITATION TEAMS. Are they in place? Are they trained? Are they supervising unit preventive medicine?

- PREVENTIVE MEDICINE DETACHMENT. Are they conducting vector surveillance and control? Did they verify the risk of the entomological threat? Are control measures possible/practical? Have they initiated vector control?

(e) Surveys conducted during deployments to Somalia (1993) and Haiti (1995) suggest many soldiers were relatively unfamiliar with personal protection doctrine and did not routinely practice it. Recent experience in Afghanistan (2002) and Iraq (2003) indicates that this is still the case.

- SOMALIA. One Marine infantry battalion suffered a serious out break of a vector-borne disease. One month after arrival, 8 percent of the battalion had come down with mosquito-borne diseases (44 cases of dengue and 19 cases of malaria). The results of a questionnaire survey revealed that while 80 percent reported mosquito bites, 40 percent never used repellent, 44 percent did not sleep under bed nets, and 64 percent did not roll down sleeves. Permethrin was available, but 21 percent did not treat their uniforms, and 28 percent did not treat their bed nets. Also, the commander had a macho attitude about using protective measures that undoubtedly had a negative effect on the use of protection measures (Horosko, 1996).

- HAITI. Soldiers deployed to Haiti participated in a survey about knowledge and use of personal protection measures. Results revealed that while 53 percent were bitten by insects daily or almost daily, 42 percent of commanders did not emphasize use of repellents, 65 percent did not have treated BDUs (only 9 percent treated their BDUs before deployment, an additional 26 percent applied treatment while deployed), and 70 percent of the units did not deploy with functioning FSTs (Gambel, 1996).

(f) Results of the studies summarized above and experience since indicate that a force protection estimate in the center of the range (moderate), at best, is appropriate in most deployment situations until actual "on the ground" unit data are available.

CHAPTER 4

ENTOMOLOGICAL OPERATIONAL RISK ASSESSMENT

4.1 EORA FORMAT

Once an Entomological Operational Risk Estimate has been established for all identified entomological hazards, an EORA is prepared and disseminated for the desired country. The format of the EORA includes—

a. A table giving the risk estimates for each hazard listed in order of priority according to their impact on operations along with their respective hazard severity and hazard probability estimates.

b. Key points for each hazard addressing risk period, risk distribution, vector information, pathogen information, and drug resistance.

c. List of other diseases of military importance that pose a health threat.

d. Force protection measures appropriate to the hazards: personal protective measures, chemoprophylaxis, and vaccination.

e. Priorities of preventive medicine personnel.

f. Also included are references, point of contact for additional information, Vector-borne Disease Risk Maps, Risk Matrix and Hazard Severity Definitions, and Hazard Probability and Matrix estimates for each disease.

4.2 EORA EXAMPLE

See Appendix C for an example of a published EORA.

APPENDIX A

REFERENCES

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APPENDIX B

EXPECTED DISEASE LEVEL ESTIMATE

B.1 STANDARDIZED METHODOLOGY

The standardized methodology developed by AFMIC to estimate the Expected Disease Level (EDL) in U.S. Forces is presented in this Appendix. Additional information on AFMIC's risk assessment process can be found in the AFMIC Infectious Disease Risk Assessment Appendix at their web site.

B.2 DISEASES AND THE RISK POSED TO U.S. FORCES

Diseases are inherently different and highly variable in the risk they pose to U.S. Forces. They will vary as to their potential to degrade operations, the seriousness of the disease, and the likelihood of exposure. These variables are addressed by the EDL. The EDL provides the medical planner an estimate of what percentage of personnel are likely to be affected by a particular disease in a particular country. This estimate is derived from the relation between MER and endemicity. MER estimates the seriousness of potential military important diseases. Endemicity estimates the likelihood of exposure of the U.S. Force to the pathogen.

B.3 DISEASES OF POTENTIAL MILITARY SIGNIFICANCE

a. Diseases capable of degrading military operations, including severe diseases expected to occur infrequently or sporadically among deployed U.S. military personnel are selected for risk assessment. Diseases identified as Entomological Hazards are listed in Table B.1.

b. The diseases of potential military significance are selected based on the following assumptions about the U.S. military population:

(1) Personnel are healthy active duty members medically qualified for deployment, with a competent immune system, good nutritional status, routine childhood immunizations, and no chronic debilitating medical problems.

(2) Personnel are living in field conditions typical of a tactical military operation.

(a) Personnel living in tent camps, individual shelters, or austere pre-existing structures adapted for temporary inhabitation.

(b) Human waste is handled through temporary field sanitation measures (such as, field latrines, slit trenches, and “cat-holes").

(c) Food is provided in a military field mess facility, and/or meals-ready-to-eat.

(d) Water is mainly provided via a treatment and distribution system operated by or monitored by the military.

(e) Contact with flying and crawling arthropod vectors is significant (where applicable).

(f) Contact with rodents or other animals occurs (where applicable).

(3) Personnel have frequent off-duty exposure to the local economy—

(a) Personnel have access to local food and water.

(b) Personnel have frequent casual contact with the local population.

(c) The potential exists for contact with commercial sex workers.

(d) Prolonged household-type contact with the local population is minimal.

(4) Personnel are dispersed throughout an area and may be mobile, resulting in a variety of different exposures (that is, not everyone is usually exposed to the same small focal area)

(5) Risk level assumes that NO COUNTERMEASURES are being implemented—

(a) No vaccines (except routine childhood vaccines).

(b) No chemoprophylaxis.

(c) No personal protective measures against biting vectors (such as, DEET, permethrin, and bednets).

(d) No specific avoidance of contact with soil, dust, surface water, or animals.

B.4. EXCLUDED DISEASES

Specific diseases are excluded if they meet any of the criteria below:

a. The disease is not expected to degrade military operations by affecting a large percentage of personnel (such as, echinococcosis and trichinosis), or is not severe.

b. The disease occurs commonly worldwide (such as, influenza and fungal dermatitis).

c. Personnel are well protected by routine childhood immunizations (such as, measles and tetanus).

B.5 MAXIMUM EXPECTED RATE

a. For each disease of potential military significance, AFMIC has made an estimate of the "worst case" MER of symptomatic infections for adult U.S. Forces population under very high natural exposure conditions. The MER for diseases identified as Entomological Hazards are listed in Table B.1.

b. The factors considered in estimating MER—

(1) Asymptomatic to symptomatic ratio.

(2) Efficiency of transmission.

(3) History of outbreaks, infection rates and natural epidemiology of the disease.

(4) Likelihood of encountering an infectious dose.

c. The MER expressed as the percentage of personnel that are likely to develop a symptomatic infection of the disease in one month in the categories listed below—

(1) Rates may exceed 50 percent per month.

(2) Rates may be as high as 11-50 percent per month.

(3) Rates may be as high as 2-10 percent per month.

(4) Rates may be as high as 1 percent per month.

(5) Sporadic or infrequent cases may occur (1 per 1000).

B.6 ENDEMICITY

a. Endemicity is used to estimate how much exposure a deployed U.S. Force might have to a particular infectious agent in a particular country. This estimate is intended to reflect the likelihood of exposure of the U.S. Force to the pathogen.

b. AFMIC assesses the degree of exposure that the local population has to the pathogen. This assessment is based on analysis of multiple sources of data, including official surveillance reports, outbreak investigations, serosurveys of the local population, World Health Organization or other official estimates of prevalence, studies in the medical literature, and other available data. Overall living conditions are also taken into account in the assessment. A critical appraisal is performed on the data from the various sources, as follows:

(1) Does it suggest the presence of disease?

(2) Does it confirm the presence of disease?

(3) Does it support a rough estimate of endemicity?

(4) Does it support a definitive estimate of endemicity?

c. Level of endemicity is estimated using the following definitions of infection or exposure rates in the local population—

(1) HIGHLY ENDEMIC: 50 percent or more is typically infected.

(2) INTERMEDIATE: 11-50 percent is typically infected.

(3) LOW: 2-10 percent is typically infected

(4) SPORADIC: Approximately 1 percent is typically infected.

(5) RECRUDESCENT: Exposure varies considerably from year to year.

B.7 EXPECTED DISEASE LEVEL IN U.S. FORCES

a. The EDL provides the medical planner an estimate of the percentage of U.S. Forces that are likely to be affected by a particular disease in a particular country in the absence of countermeasures.

b. The Expected Disease Level Matrix (Table B.2) is used to guide this assessment. The matrix relates the MER of a particular disease to its level of endemicity in a particular country. EDL is estimated using one of the following categories:

(1) An operationally significant number - potentially over 50 percent per month.

(2) An operationally significant number - as high as 11-50 percent per month.

(3) An operationally significant number - as high as 2-10 percent per month.

(4) A small number - potentially as high as 1 percent per month.

(5) Infrequent or sporadic numbers of cases could occur - potentially as high as 1 per 1000 per month.

(6) Cases are not expected to occur.

TABLE B.1 MAXIMUM EXPECTED RATES (MER)

MER is an estimate made by AFMIC of the "worst case" monthly rate of symptomatic infections for an adult US military population under very high natural exposure conditions.

DISEASE	MER	WHEN EXPOSED TO:
African tick bite fever (African tick typhus)	UP to 1%	Ticks
African tick typhus (African tick bite fever)	UP to 1%	Ticks
Anthrax	1 per 1000	Animals
Argentinean hemorrhagic fever (Junin)	UP to 1%	Rodent infested areas
Bartonellosis (Oroya fever)	2-10%	Sand flies
Bhanja virus fever	UP to 1%	Ticks
Bolivian hemorrhagic fever (Machupo)	UP to 1%	Rodent infested areas
Boutonneuse fever (Mediterranean spotted fever)	UP to 1%	Ticks
Bunyamwera fever	2-10%	Mosquitoes
Bwamba fever	2-10%	Mosquitoes
California group viruses	2-10%	Mosquitoes
Chagas disease (Trypanosomiasis - American)	1 per 1000	Reduviid bugs
Chikungunya	11-50%	Mosquitoes
Crimean-Congo hemorrhagic fever	UP to 1%	Ticks
Dengue fever	11-50%	Mosquitoes
Eastern equine encephalitis	1 per 1000	Mosquitoes
Ehrlichiosis	UP to 1%	Ticks
Filariasis	1 per 1000	Mosquitoes
Group C virus	2-10%	Mosquitoes
Guanarito (Venezuelan hemorrhagic fever)	1 per 1000	Rodent infested areas
Hantavirus – HFRS	UP to 1%	Rodent infested areas
Hantavirus pulmonary syndrome	1 per 1000	Rodent infested areas
Japanese encephalitis	UP to 1%	Mosquitoes
Junin (Argentinean hemorrhagic fever)	UP to 1%	Rodent infested areas
Kemerovo virus	UP to 1%	Ticks
Kyasanur Forest disease	UP to 1%	Ticks
Lassa fever	UP to 1%	Rodent infested areas
LaCrosse encephalitis	2-10%	Mosquitoes
Leishmaniasis – cutaneous	2-10%	Sand flies
Leishmaniasis – mucosal	2-10%	Sand flies
Leishmaniasis – visceral	UP to 1%	Sand flies
Leptospirosis	2-10%	Surface water or mud
Lipovnik virus	UP to 1%	Ticks
Lyme disease	UP to 1%	Ticks
Machupo (Bolivian hemorrhagic fever)	UP to 1%	Rodent infested areas
Malaria	11-50%	Mosquitoes

TABLE B.1 MAXIMUM EXPECTED RATES (MER) (CONTINUED)

DISEASE	MER	WHEN EXPOSED TO:
Mayaro virus	2-10%	Mosquitoes
Mediterranean spotted fever (Boutonneuse fever)	UP to 1%	Ticks
Murine typhus (Typhus - flea-borne)	2-10%	Fleas and rodents
Murray Valley (Australian) encephalitis	1 per 1000	Mosquitoes
North Asian tick fever (Siberian tick typhus)	UP to 1%	Ticks
Ockelbo (Sindbis) virus	2-10%	Mosquitoes
Omsk hemorrhagic fever	UP to 1%	Ticks
ONyongNyong	11-50%	Mosquitoes
Oropouche virus	11-50%	Mosquitoes
Oroya fever (Bartonellosis)	2-10%	Sand flies
Plague	UP to 1%	Fleas and rodents
Powassan virus encephalitis	1 per 1000	Ticks
Q fever	2-10%	Animals
Quintana fever (Trench fever)	UP to 1%	Lice
Rabies	1 per 1000	Animals
Relapsing fever (Louse-borne)	2-10%	Lice
Relapsing fever (Tick-borne)	UP to 1%	Ticks
Rift Valley fever	2-10%	Mosquitoes
Rocio encephalitis	UP to 1%	Mosquitoes
Rocky Mountain spotted fever	UP to 1%	Ticks
Ross River virus	2-10%	Mosquitoes
Sand fly fever	2-10%	Sand flies
Schistosomiasis	2-10%	Water and snails
Scrub typhus (Typhus - mite-borne)	2-10%	Mites
Siberian tick typhus (North Asian tick fever)	UP to 1%	Ticks
Sindbis (Ockelbo) virus	2-10%	Mosquitoes
Spotted fever group (Tick-borne rickettsioses)	UP to 1%	Ticks
St. Louis encephalitis	UP to 1%	Mosquitoes
Syr-Darya Valley fever	UP to 1%	Ticks
Tahyna virus	2-10%	Mosquitoes
Tick-borne encephalitis	UP to 1%	Ticks
Tick-borne rickettsioses (Spotted fever group)	UP to 1%	ticks
Trench fever (Quintana fever)	UP to 1%	Lice
Trypanosomiasis - African	UP to 1%	Tsetse flies
Trypanosomiasis - American (Chagas disease)	1 per 1000	Reduviid bugs
Typhus - flea-borne (Murine typhus)	2-10%	Fleas and rodents
Typhus - louse-borne	UP to 1%	lice

TABLE B.1 MAXIMUM EXPECTED RATES (MER) (CONTINUED)

DISEASE	MER	WHEN EXPOSED TO:
Typhus - mite-borne (Scrub typhus)	2-10%	Mites
Venezuelan equine encephalitis	2-10%	Mosquitoes
Venezuelan hemorrhagic fever (Guanarito)	1 per 1000	Rodent infested areas
West Nile fever	UP to 1%	Mosquitoes
Western equine encephalitis	1 per 1000	Mosquitoes
Yellow fever	2-10%	Mosquitoes

TABLE B.2 EXPECTED DISEASE LEVEL MATRIX

EXPECTED DISEASE LEVEL				
MER	ENDEMICITY			
	Sporadic	Low	Intermediate	High
1/1000	Cases Not Expected	Cases Not Expected	Infrequent/Sporadic 1 per 1000	Infrequent/Sporadic 1 per 1000
1%	Cases Not Expected	Infrequent/Sporadic 1 per 1000	Infrequent/Sporadic 1 per 1000	Small Number Up to 1%
2-10%	Infrequent/Sporadic 1 per 1000	Small Number Up to 1%	Small Number Up to 1%	Operationally Significant 2-10%
11-50%	Infrequent/Sporadic 1 per 1000	Small Number Up to 1%	Operationally Significant 2-10%	Operationally Significant 11-50%
> 50%	Small number Up to 1%	Operationally Significant 2-10%	Operationally Significant 11-50%	Operationally Significant >50%

APPENDIX C
SAMPLE ENTOMOLOGICAL OPERATIONAL RISK ASSESSMENT

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IRAQ
Entomological Operational Risk Assessment

Information Cutoff Date: 27 September 2002 Production Date: 2 October 2002

Characterization of entomological risk is provided for preventive medicine personnel who are responsible for health risk management advice provided to unit commanders and leaders during operational planning.

Operational Risk Management Estimate for Vector-borne and Zoonotic Diseases:

Disease of Concern - Iraq	Risk Estimate	Risk Assessment Matrix	
Malaria	Low	Hazard Severity	Negligible
		Hazard Probability	Likely

Malaria

- Malaria risk exists in the eastern half of the country. (See Map)
- Malaria transmission is higher in northeastern provinces.
- 99% P. vivax.
- Transmission occurs May - Nov.

Other vector-borne and zoonotic diseases. Other diseases such as: Such as: Crimean-Congo hemorrhagic fever, leishmaniasis, schistosomiasis and rabies occur in Iraq. While they pose a health threat to soldiers, they are unlikely to be a medical threat to operations.

Force Protection Measures:

- **Malaria chemoprophylaxis.** Use malaria chemoprophylaxis Apr-Dec.
  Resistance must be taken into account when selecting chemoprophylaxis medication
- **Personal protective measures**. Use skin and clothing repellents and sleep under treated bed nets Apr-Dec. (DEET - NSN 6840-01-284-3982, IDA Kit - NSN 6840-01-345-0237, Aerosol Permethrin - NSN 6840-01-278-1336, Bet Net - NSN 7210-00-266-9736).
- Avoid bare skin contact with fresh water in lakes and marshes.
- Avoid/minimize contact with domestic and wild animals.

Priorities of Preventive Medicine Personnel:

- Insure/monitor use of chemoprophylaxis Apr to Dec.
- Insure/monitor use of personal protective measures Apr to Dec.
- Conduct vector surveillance and control.
  Monitor presence of Anopheles mosquitoes Apr to Dec.

For Additional Information:

- Richard Wells, USACHPPM, Entomological Sciences Program, 410.436.3613 (DSN 584).
- AFMIC, 301.619.7574 (DSN 343).

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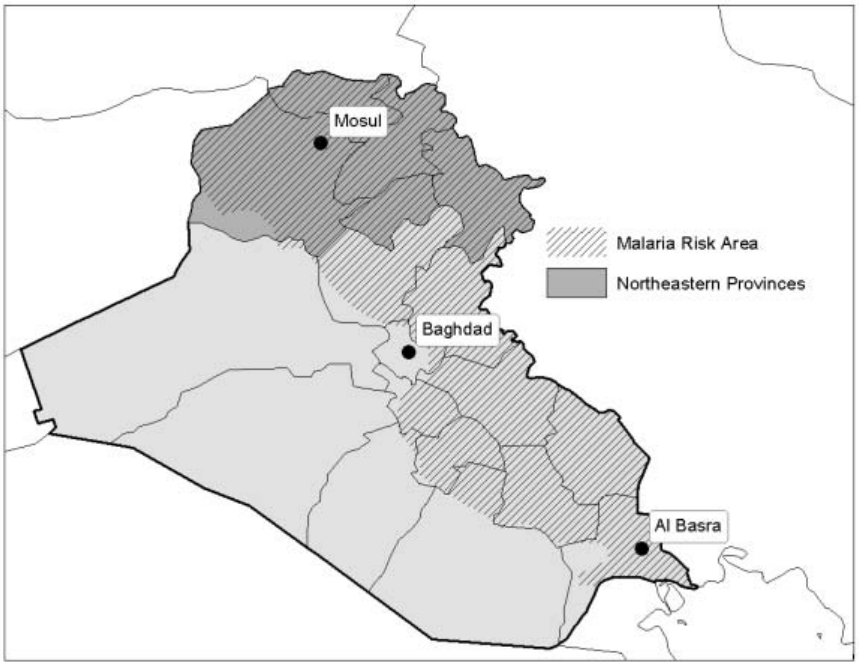
Iraq Malaria Risk Map:



Return to Risk Estimate

References:

- AFMIC Web Site, Infectious Disease Risk Assessment - Sep 02
- AFMPB, Disease Vector Ecology Profile, Middle East, Oct 1999
- WHO Roll Back Malaria Web Site (mosquito.who.int)
- CDC Traveler's Heath Web Site (cdc.gov)
- Fit for Travel Web Site (fitfortravel.scot.nhs.uk)
- USACHPPM, TG 248, Guide for Deployed Preventive Medicine Personnel on Health Risk Management, 1 August 2001
- Field Manual No. 100-14, Risk Management, 23 April 1988
- Armed Forces Pest Management Board TG 36 - Personal Protective Techniques Against Insects and Other Arthropods of Military Importance.

Definitions:

Operational Risk Management Estimate.

- Extremely High. Loss of ability to accomplish the mission or mission failure.
- High. Significantly degraded mission capability or unit readiness.
- Moderate. Degraded mission capability or unit readiness.
- Low. Little or no adverse impact on mission capability.

Return to Risk Estimate

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Hazard Severity Rank.

- Catastrophic. At highest exposure levels more than 50 % per month of personnel exposed to vectors could develop disease.
- Critical. . At highest exposure levels 11 - 50 % per month of personnel exposed to vectors could develop disease
- Marginal. At highest exposure levels 2 - 10 % per month of personnel exposed to vectors could develop disease.
- Negligible. At highest exposure levels up to 1 % per month of personnel exposed to vectors could develop disease.

Return to Risk Estimate

Hazard Probability Rank: Relationship between force protection measures and exposure to vectors/vector-borne disease.

Malaria

Force Protection Measures	Exposure to Vectors/Vector-borne Disease (High → Low)				
Low	Frequent	Frequent	Likely	Occasional	Occasional
	Frequent	Likely	Likely	Occasional	Seldom
	Likely	Likely	Occasional	Occasional	Seldom
	Occasional	Occasional	Occasional	Seldom	Unlikely
High	Occasional	Seldom	Seldom	Unlikely	Unlikely

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APPENDIX D

GLOSSARY

D.1 ACRONYMS

AFMIC - Armed Forces Medical Intelligence Center

AFPMB - Armed Forces Pest Management Board

BDU – Battle Dress Uniform

DOD – Department of Defense

DOWW - Disease Occurrence - Worldwide

DVEP - The Disease Vector Ecology Profiles

EDL – Expected Disease Level

EORA - Entomological Operational Risk Assessment

FM – Field Manual

FST - Field Sanitation Team

IDRA - Infectious Disease Risk Assessment

MEDIC - Medical Environmental Disease Intelligence and Countermeasures

MER - Maximum Expected Rate.

OEH - Occupational and environmental health

ORM - Operational risk management

TG – Technical Guide

D.2 TERMS AND DEFINITIONS

Diseases of greatest risk - Diseases that have the greatest likelihood to degrade operations by affecting a large percentage of personnel, or by causing severe illness in a smaller percentage.

Diseases of potential military significance - Diseases capable of degrading military operations.

Diseases of potential risk - Diseases that have a lower likelihood to degrade operations because they generally affect a smaller percentage of personnel, or cause mild symptoms. However, under certain circumstances, they could significantly impact operations.

Endemicity - Used to estimate likelihood of exposure a deployed U.S. Force might have to a particular infectious agent in a particular country.

Expected Disease Level (EDL) - Provides the medical planner an estimate of the percentage of U.S. Forces that are likely to be affected by a particular disease in a particular country in the absence of countermeasures.

Hazard - Any potential source of injury, illness, or death of personnel.

Health threat - A threat to an individual soldier's health, which may not affect the health of the unit.

Long Incubation - More than 15 days between exposure and onset of symptoms.

Maximum Expected Rate (MER) - Estimates the seriousness of the disease and its impact on operations.

Medical threat - A health threat that has the potential to degrade a unit's combat or mission effectiveness.

Risk -The projected level of health impact of a particular hazard for a particular population in particular circumstances.

Short Incubation - Less than 15 days between exposure and onset of symptoms.

Threat - The sum or combination of all health hazards in a given location.

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