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Standard Guide for Environmental Health Site Assessment Process for Military Deployments¹

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1. Scope

1.1 *Purpose*—The purpose of this guide is to describe a scientific methodology for conducting environmental health site assessments (EHSAs) for military deployments. EHSAs are prepared to evaluate potential environmental exposures that may impact the health of deployed personnel as directed by Presidential Review Directive 5; Chairman, Joint Chiefs of Staff memorandum MCM-0006-02 ; and Department of Defense Instruction 6490.3. This guide is intended to assist the user in developing conceptual site models (CSMs) for deployment sites. CSMs are used to define the exposure pathways. The exposure pathways assist in the evaluation of potential health impacts. The goal of this guide is to identify complete and potentially complete exposure pathways that may affect the health of deployed personnel.

1.2 This guide provides a series of steps designed to obtain sufficient information to evaluate potential environmental exposures that may affect the health of deployed personnel. It is most applicable when only a limited amount of information about the deployment area is available. If it becomes apparent to the environmental health professional in predeployment planning activities that sufficient information exists to evaluate the health significance of potential environmental exposures, it will not be necessary to complete the data collection activities described in this process. In this event, the environmental health professional will document their justification for not completing the data collection activities. An obvious example would be deployment to a major city in a developed county.

1.3 Information generated by this process will be used for environmental health risk assessments. Environmental health risk assessments are beyond the scope of this guide.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory requirements prior to use.*

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2. Referenced Documents

2.1 DoD References:²

- Presidential Review Directive 5, *Planning for Health Preparedness and Readjustment of the Military, Veterans, and Their Families After Future Deployments*, August 1998
- Department of Defense Instruction (DoDI) 6490.3, *Implementation and Application of Joint Medical Surveillance for Deployments*, 1997
- Office of the Chairman, The Joint Chiefs of Staff Memorandum MCM-0006-02, *Updated Procedures for Deployment Health Surveillance and Readiness*, February 2002
- Department of the Army (DA), *Risk Management*, FM 100-14, April 1998
- OPNAVINST 3500.39A/Marine Corps Order 3500.27A, *Operational Risk Management*, September 2000
- Air Force Instruction 90-901, *Operational Risk Management*, April 2000
- U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) TG 230, *Chemical Exposure Guidelines for Deployed Personnel*, January 2002, updated April 2002
- U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) TG 236A, *Basic Radiological Dose Estimation—A Field Guide* (Draft, August 2001)
- U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) TG 248, *Guide for Deployed Preventive Medicine Personnel on Health Risk Management*, August 2001
- U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) TG 251 (Draft) *A Soldier's Guide to Environmental and Occupational Health Field Sampling During Military Deployment*, November 2001
- U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) TG 288, *Entomological Operational Risk Management*, September 2003
- Defense Intelligence Agency, Defense Intelligence Report, DI-1816-6-99, *Medical Intelligence Assessment of Deployment Environmental Health Risks*, January 1999

² Available from DODSSP, Building 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098.

Armed Forces Pest Management Board, *Guide to Entomological Surveillance During Contingency Operations*, October 2001

NOTE 1—Other potentially useful information sources are listed in **Appendix X4**.

3. Terminology

3.1 Definitions:

3.1.1 *actual knowledge, n*—knowledge actually possessed by an individual who is a real person, rather than an entity. Actual knowledge is to be distinguished from constructive knowledge, that is, knowledge imputed to an individual or entity.

3.1.2 *adjoining properties, n*—properties directly adjacent to the deployment site.

3.1.2.1 *Discussion*—The term generally includes properties adjoining the deployment site even across public thoroughfares such as roads and railroads.

3.1.3 *anthropogenic background, n*—refers to natural and human-made substances present in the environment that result from human activities such as burning fossil fuels, industrial production, and domestic activities.

3.1.4 *area of concern (AOC), n*—area in which environmental contamination is suspected or a potential release may occur.

3.1.5 *complete or potentially complete exposure pathway, n*—five elements of an exposure pathway (source of contamination, environmental media and transport mechanism, point of exposure, route of exposure, and receptor population) which link the contaminant source to the receptor population.

3.1.5.1 *Discussion*—If a complete exposure pathway exists or may exist during the foreseeable use of the deployment site, the receptor population is considered exposed.

3.1.6 *conceptual site model, n*—written description and visual representation of the known, suspected, and/or predicted relationships between the environmental health threats identified at the deployment site and the human receptors.

3.1.6.1 *Discussion*—The conceptual site model identifies the environmental health threats and the exposure pathways at the deployment site.

3.1.7 *credible knowledgeable individual, n*—person with credible knowledge of the uses and physical characteristics of the deployment site.

3.1.7.1 *Discussion*—Such an individual is often the property manager, health or safety official, or a maintenance person responsible for the site.

3.1.8 *data quality objectives, n*—specification of the amount and quality of data required to complete the environmental health site assessment adequately so that an operational risk management decision can be made.

3.1.9 *deployment site, n*—geographic area of a military deployment covered by an EHSA. This area varies with the mission and may contain multiple areas of concern.

3.1.10 *environmental health professional, n*—refers to trained preventive medicine personnel as defined and designated by the Services as qualified by training and experience to perform the environmental health site assessment.

3.1.10.1 *Discussion*—This includes personnel such as U.S. Army Preventive Medicine Officers in the 67C series, U.S. Navy Industrial Hygiene Officers, U.S. Navy Environmental Health Officers, U.S. Air Force Bioenvironmental Engineers, and noncommissioned officers with specialized training in the environmental health sciences such as U.S. Army Preventive Medicine Specialists, U.S. Navy Preventive Medicine Technicians, and U.S. Air Force Bioenvironmental Engineering Technicians and equivalent skill sets for DoD and contract civilian employees.

3.1.11 *environmental health site assessment (EHSA), n*—iterative, scientifically defensible process (described in this guide) used to identify complete or potentially complete exposure pathways that may affect the health of deployed personnel. EHSAs are conducted to facilitate evidence-based risk management action.

3.1.12 *environmental health threat, n*—any naturally occurring or man-made hazard (chemical, radiological, or biological) that can cause injury, illness, disease, adverse health conditions, or death in deployed personnel. It does not include threats related to occupational health exposures or weapons of mass destruction.

3.1.13 *environmental receptor, n*—humans and other living organisms potentially exposed to and adversely affected by environmental health threats if there is a complete or potentially complete exposure pathway.

3.1.14 *exposure pathway, n*—course a chemical(s) of concern or environmental health threat takes from the source area(s) to a receptor. An exposure pathway describes the mechanism by which an individual or population is exposed to an environmental health threat.

3.1.15 *exposure route, n*—process by which an environmental health threat in the environment comes into direct contact with the body, tissues, or exchange boundaries of an environmental receptor organism, for example, ingestion, inhalation, and dermal absorption.

3.1.15.1 *Discussion*—Injection is another exposure route that can be considered if appropriate; however, the potential for occurrence in the ambient environment is far less than that of the other exposure routes described above and is not discussed in detail in this guide.

3.1.16 *hazardous material, n*—any material or substance that, if part of the complete or potentially complete exposure pathway, could affect the health of deployed personnel. These substances include but are not limited to materials subject to regulation under the Hazardous Material Transportation Act, 49 CFR 171 et seq., or the Transportation of Dangerous Goods Directorate of Transport Canada.

3.1.17 *host nation representative, n*—person identified through the environmental health site assessment process that is knowledgeable about the deployment site. The person can be a designated representative or an individual selected by the environmental health professional.

3.1.18 *interviews, n*—those portions of this guide that are contained in Section 7 and address questions to be asked of credible knowledgeable individuals.

3.1.19 *military deployment, n*—for the purpose of this guide, a military deployment is defined as a deployment that

resulting from a Joint Chiefs of Staff (JCS)/combatant command deployment order for 30 continuous days or greater to a land-based location outside the United States. This deployment location does not have permanent U.S. military medical treatment facilities (that is, funded by the Defense Health Program) and may or may not be directly supported by deployed medical forces.

3.1.20 *mission*, *n*—task, together with the purpose and scope, that clearly indicates the action to be taken and the reason for the military deployment.

3.1.21 *obvious*, *adj*—that which is plain or evident; a condition or fact that could not be ignored or overlooked by a reasonable observer while visually or physically observing the deployment site or area of concern.

3.1.22 *operational risk management (ORM)*, *n*—Department of Defense process for identifying, assessing, and controlling risks as well as evaluating the effectiveness of risk control measures.

3.1.22.1 *Discussion*—The Department of Defense risk management doctrine provides commanders with methods to evaluate and manage risks posed by the mission. Leaders manage risk by evaluating hazards and implementing operational risk management (ORM) options continuously during a mission.

3.1.23 *potentially complete exposure pathway*, *n*—situation with a reasonable chance of occurrence in which a receptor may be exposed, directly or indirectly, to the environmental health threat.

3.1.24 *predeployment activities*, *n*—all actions taken by the environmental health professional to prepare for a deployment including defining the mission of the deploying forces, reviewing all readily available information on the area of military deployment, preparing a preliminary hazard assessment, and communicating potential health threats to the mission commander.

3.1.25 *preliminary hazard assessment (report)*, *n*—process of reviewing relevant intelligence data, previous assessments, and/or other available predeployment data for the area of military deployment to determine if potential environmental health threats exist to deploying forces.

3.1.25.1 *Discussion*—The preliminary hazard assessment includes information on the mission, adversary, terrain and weather, climate, length of deployment, type of forces employed, and the host nation population. The analysis is part of the ORM process, which is outside the scope of this guide. However, the predeployment activities included in this guide substantially overlap the activities performed as part of the ORM process. The preliminary hazard assessment provides environmental health professionals with their first opportunity to communicate potential environmental health threats to the mission commander and deploying forces. This communication typically takes the form of predeployment command or unit level briefings, or both, designed to influence operational risk management planning and inform deploying personnel about potential health risks.

3.1.26 *sampling*, *v*—collection of field data as part of the EHSA process using field instruments, field analytical methods, as well as samples collected in the field for analyses by off-site laboratories.

3.1.27 *site reconnaissance (site visit)*, *n*—refers to the process in which an environmental health professional or other designated individual visually and physically observes the deployment site, structure(s) located on the deployment site, and the area surrounding the deployment site.

3.1.27.1 *Discussion*—Site reconnaissance is used to validate the information from predeployment activities and obtain additional information about complete or potentially complete exposure pathways that exist that could affect the health of deployed forces. For the purpose of this guide, the term site visit is synonymous with the term site reconnaissance.

3.1.28 *source*, *n*—location from which a contaminant(s) has entered or may enter a physical system. A primary source, such as a location where drums or other containers have leaked onto surface soils, may produce a secondary source, such as contaminated soils; sources may hence be primary or secondary.

3.1.29 *vadose zone*, *n*—unsaturated area between the surface of the land and the surface of the water table.

3.1.29.1 *Discussion*—The pore spaces (openings in the soil) also typically contain air or other gases.

3.1.30 *visually or physically observed conditions, or both*, *n*—conditions evident to the senses of sight and smell during site reconnaissance.

3.1.30.1 *Discussion*—For example, while walking through a deployment site and the structures located on it, conditions may be visually observed, such as stained soil, or recognized by the sense of smell, such as noxious or foul odors.

3.2 *Acronyms:*

3.2.1 *AOC*—area of concern

3.2.2 *CSM*—conceptual site model

3.2.3 *DQO*—data quality objectives

3.2.4 *DoD*—Department of Defense

3.2.5 *EHSA*—environmental health site assessment

3.2.6 *MGRS*—military grid reference system

3.2.7 *ORM*—operational risk management

3.2.8 *QA/QC*—quality assurance/quality control

3.2.9 *SOP*—standard operating procedure/standing operating procedure

3.2.10 *TG*—technical guide

3.2.11 *USACHPPM*—U.S. Army Center for Health Promotion and Preventive Medicine

3.2.12 *USEPA*—U.S. Environmental Protection Agency

4. Significance and Use

4.1 The environmental health site assessment process for military deployments is a guide for the iterative, scientifically defensible process that is used to identify complete or potentially complete exposure pathways for chemical, biological, and radiological compounds in the environment that may affect the health of deployed personnel. It describes a five-step process for collecting environmental site data, identifying, and assessing AOCs to collect and document appropriate information to complete EHSA and facilitate the operational risk management (ORM) decision-making process.

4.1.1 Uncertainty and risk are inherent in the nature of military action. ORM is a process used by military commanders for identifying hazards, assessing risks, and implementing controls to reduce the risks posed by military operations.

the ORM process, hazard probability (unlikely, seldom, occasional, likely, and frequent) and hazard severity (negligible, marginal, critical, and catastrophic) is estimated using the guidelines for given chemicals listed in TG 230 and entomological hazards in TG 288. The probability and severity are cross-referenced in a matrix to produce a risk estimate (low, moderate, high, and extremely high). Although data gathered during the EHSA process may be used by a commander during mission planning and execution, ORM is outside the scope of this guide.

4.1.2 The environmental health professional performing an EHSA should be aware that other environmental site assessments such as environmental baseline surveys might be available or conducted concurrently. Coordination with other environmental evaluation activities may be of mutual benefit.

4.2 This guide is intended for use during military deployments for collecting pertinent site information necessary to complete a comprehensive EHSA. It is designed to enable deployed personnel to evaluate environmental conditions and assess the risks of acquiring diseases and nonbattle injuries from environmental health threats to deployed personnel. This guide defines a series of steps for gathering environmental information quickly and accurately. The environmental health professional(s) analyze the environmental information and communicate environmental health threats to commanders. For example, field commanders deploying troops to forward locations must decide whether or not to bed down in specific areas. The information on environmental health threat is critical for a commander to make an informed decision.

4.3 The process of identifying potential environmental health threats, source areas, environmental media, points of exposures, potential exposure routes, and receptors define a CSM. Development of this model is critical for determining potential exposure routes (for example, ingestion and inhalation) and for identifying the possible impact of the environmental health threat on deployed personnel health. Uncertainties associated with the CSM shall be identified early in the process so that efforts can be made to reduce uncertainties to acceptable levels. Early iterations of the CSM, which are usually based on limited or incomplete information, shall identify and emphasize the uncertainties that require further evaluation.

4.4 The CSM development is an iterative process. As the EHSA is performed, additional information collected during site reconnaissance, interviews with credible knowledgeable individuals and sampling are used to refine and validate the CSM. Change(s) in the mission or conditions at the deployment site may also require reevaluation and adjustments to the CSM.

4.5 The CSM(s) is specific to an AOC(s) and represents various complete or potentially complete exposure pathways associated with the AOC. For deployment sites with multiple AOCs, a complex CSM or multiple CSMs may be necessary.

4.6 The CSM is used to integrate all of the relevant information at the AOC and to determine whether information including data is missing (data gaps) and whether additional information should be collected at the AOCs. All personnel involved in developing CSM should be familiar with the use

and application of this guide. The CSM should be used to enable experts from various disciplines to communicate effectively with one another, resolve issues concerning the AOC, and facilitate the ORM decision-making process.

4.7 This guide is not intended to be used for documenting the individual exposure(s) of deployed military personnel to environmental health threats.

5. Environmental Health Site Assessment Process

5.1 *Objective*—The purpose of the EHSA is to identify complete or potentially complete exposure pathways at deployment sites that may affect the health of deployed personnel. In most cases, the EHSA will involve some form of sampling and analysis to confirm the presence of complete or potentially complete exposure pathways. Data generated via this sampling and analysis may be used to conduct environmental health risk assessments. Environmental health risk assessments are beyond the scope of this guide.

5.2 *Five Components*—The EHSA will typically consist of five discrete steps. These are illustrated in Fig. 1 and summarized as follows:

5.2.1 *Predeployment Activities*—During the predeployment activities, environmental health professionals gather information from a variety of sources. This includes information on the specific mission as well as on the infrastructure, population, terrain, climate, weather, and current use and historical use of the land and facilities in the area of the planned deployment. This information is used to develop a CSM that is in turn used to define potentially complete exposure pathways that may pose an environmental health threat to the deploying forces. Information gathered during predeployment activities may be summarized into a preliminary hazard assessment for the commander. The preliminary hazard assessment, which is described in various service-specific guidance documents on ORM, provides environmental health professionals with their first opportunity to communicate potential environmental health threats to the mission commander and deploying forces. In some circumstances, the quantity and quality of information available during predeployment activities may eliminate the need to complete the balance of the activities of an EHSA. When this occurs, the environmental health professional shall follow service-specific ORM procedures.

5.2.2 *Site Reconnaissance and Interviews*—Site reconnaissance is a visit to the deployment site and the area surrounding the deployment site to evaluate further complete or potentially complete exposure pathways described in the CSM. The objective of site reconnaissance is to validate the information from predeployment activities and obtain additional information about complete or potentially complete exposure pathways associated with the deployment site or a specific AOC. Interviews with credible knowledgeable individuals are conducted when appropriate to obtain historical information that may not be available from other sources and to refine further information gained by reviewing information sources during predeployment activities or direct observations during site reconnaissance, or both. Interviews may be conducted by telephone or in person. The interviews may also be conducted before, during, or after site reconnaissance. There may be occasions when the military situation may make conducting interviews

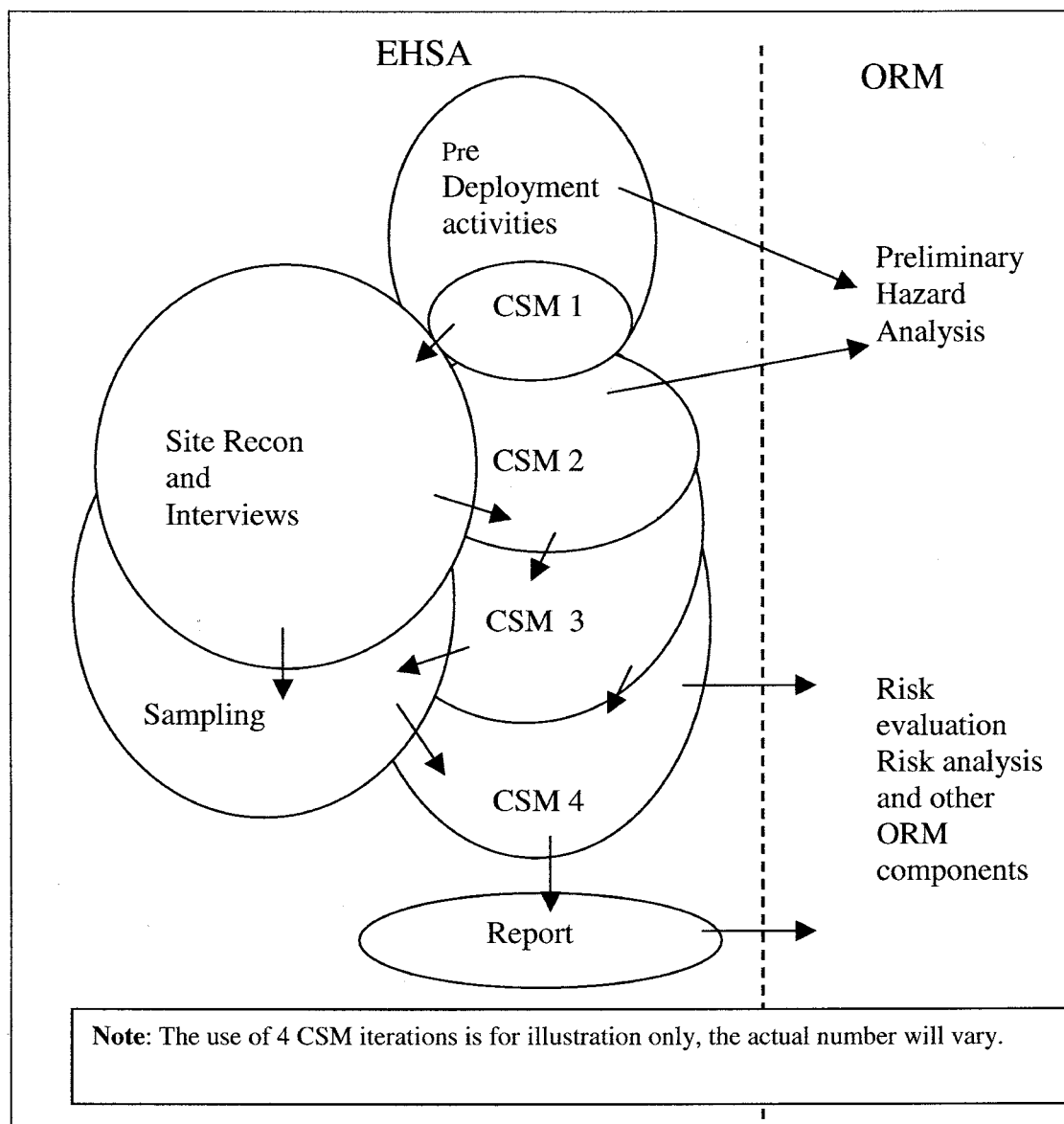


FIG. 1 EHSA Process Illustrating the Iterative Process of the Conceptual Site Model

impractical or inappropriate, or both. Information from the site reconnaissance and interviews is used to revise the CSM. The revised CSM serves to define AOCs that determine and drive the sampling activity.

5.2.3 Sampling—Sampling under this guide is conducted for one of two purposes. The first is to confirm the presence of complete or potentially complete exposure pathways by sampling in the AOC where the activities of deployed personnel may bring them in contact with specific environmental health threats. The second is associated with a monitoring program associated with assumptions of the CSM. This type of sampling is typically to document that conditions at an AOC have not significantly changed. An example would be the monitoring of a water supply to establish naturally occurring or anthropogenic background concentrations, or both, of compounds in the area of the deployment and is not covered by this

guide. Because of the large number of samples required for statistically valid results, such sampling is not the purpose and goal of this guide. Sampling for environmental health threats at areas of concern may be accomplished by using a variety of direct reading or field portable analytical instruments, or both, collecting samples that are returned to a laboratory for analysis, or any combination of these approaches. A site-specific sampling and analysis plan should direct all sampling activities.

NOTE 2—TG 251 may be consulted for examples of sampling protocols applicable to the EHSA process.

5.2.4 Conceptual Site Model (CSM)—Data gathered during predeployment activities, site reconnaissance, interviews, and sampling should be used in concert to develop a validated CSM(s) for the deployment site. The development of the CSM is an iterative process that may start with the initial model

developed during or after the predeployment activities. The model should be evaluated and revised as additional information is obtained during the course of the EHSA. A list of complete and potentially complete exposure pathways that could impact the health of the deployed personnel, derived from the validated CSM(s), is ultimately used to communicate potential health risk to the mission commander and support risk management action.

5.2.5 Report—Upon completion of the EHSA, the environmental health professional(s) shall evaluate all information obtained and prepare a verbal or written, or both, environmental health site assessment report for the operational commander. To complete the evaluation process effectively, four key elements shall be considered: findings, conclusions, discussion, and recommendations. The report also serves to document the information obtained during the EHSA. When limited documentation of the EHSA activities occurred, the report might be the only substantive record of the EHSA. Examples of limited documentation are circumstances in which multiple participants made only field notes and relied on verbally conveyed information while performing the EHSA.

5.3 This process is valid for any size deployment site. Circumstances may limit the size of the deployment site under consideration or require subdivision of a large area into multiple deployment sites as appropriate. Such action would be appropriate for large sites, sites with multiple AOCs or for administrative reasons such as balancing work effort. The environmental health professional should understand and make clear to all parties involved the actual deployment site, or subset thereof, being considered in this process.

5.4 An EHSA shall be conducted by an environmental health professional familiar with this guide and sufficiently trained in its application to be able to execute all of the elements in compliance with this guide's requirements. The environmental health professional designation shall be conveyed onto an individual based on his/her training and expertise and familiarity with the appropriate and applicable service protocols.

5.5 Environmental Health Professional Supervision—Information needed for completion of predeployment activities for the EHSA may be collected by a number of parties if the information is obtained by or under the supervision of an environmental health professional. Others may frequently perform sampling activity under the direction of the environmental health professional. Prior assessments may also contain information that will be appropriate for use in a current EHSA. The environmental health professional(s) participating in the site reconnaissance and responsible for the report shall review all of the information associated with EHSA.

5.6 Environmental Health Professional's Duties—Interviews, site reconnaissance, review, and interpretation of information upon which the report is based and overseeing the writing of the report are all components of an EHSA. If more than one environmental health professional is involved in these tasks, they shall coordinate their efforts and have clearly defined responsibilities. The environmental health professional shall be responsible for interpretation of the information collected.

5.7 Reliance—An environmental health professional is not required to independently verify information obtained during the predeployment activities and interviews and may rely on this information unless he or she has actual knowledge that certain information is incorrect or it is obvious that certain information is incorrect based on other information obtained during the EHSA.

6. Predeployment Activities

6.1 Objective—This process is designed to obtain sufficient information to allow the environmental health professional to evaluate the potential environmental health threats that may affect the health of deployed personnel. The environmental health professional may be able to obtain sufficient information to evaluate the potential environmental health threats without going through this complete process. Examples would include deployment sites in countries with effective public health, occupational health, and environmental health infrastructure.

6.1.1 If sufficient knowledge can be attained through review of readily available information, the environmental health professional may elect to evaluate the potential environmental health threats using such information. When there is an adequate information base to conclude that resident populations are not experiencing environmental health impacts from exposures that would normally be expected during deployment, then the balance of the data collection process described in this guide is not necessary.

6.1.2 The environmental health professional need not proceed with the process outlined in this document if other credible information is used to determine the presence of environmental health threats at the deployment site.

6.1.3 The environmental health professional shall document why he/she is electing not to proceed with the balance of the activities described in this guide based on their predeployment analysis.

6.2 For the purposes of this guide, the predeployment activities are those steps undertaken by the environmental health professional to determine the presence of AOC as they relate to complete or potentially complete exposure pathways, environmental health threats in the deployment area, and associated impacts to the mission that may be posed by their presence. These steps may be reiterative, depending upon the time and other constraints with respect to gathering the necessary information and the completeness of that information.

6.3 Leaders manage risk by evaluating hazards and implementing control options continuously throughout the course of the mission. The ORM approach is a process for identifying, assessing, and controlling risks as well as evaluating the effectiveness of risk control measures. The environmental health professional should participate in the ORM process by identifying environmental health threats and areas of concern, characterizing the potential impacts of environmental health threats in the context of the proposed mission, and effectively communicating appropriate control options for eliminating or minimizing those impacts.

NOTE 3—Three examples of ORM guideline documents are OP-NAVINST 3500.39A, Air Force Instruction 90-901, and the Department of the Army FM/100-14.

6.3.1 There is considerable overlap in the predeployment activities of this guide and the requirements under the ORM process for the preliminary hazard assessment. Information generated in the EHSA process may be used as part of the ORM process.

6.3.2 The mission shall define the geographic location of the operations, the time of year of such operations, the number of personnel to be deployed to the location, the type of operation to be conducted (for example, training, disaster relief, combat, and nation building) and the expected duration of the deployment. The mission may be redefined over time, based upon changing physical or political conditions in the mission area.

6.3.3 The current and historic weather patterns and climate of the deployment site as well as the topographic and geological conditions of the deployment site should be reviewed and evaluated.

6.4 *Predeployment Activities of the Environmental Health Professional:*

6.4.1 The environmental health professional should organize the information gathered from various sources regarding environmental health threats in a manner that provides timely, accurate, and relevant information to the military decision-making process. The intent of information preparation is to give the commanders and their staff information on the conditions within the operational deployment area that could affect the outcome of the mission. A key component of the information preparation is identifying, evaluating, and describing the environmental health threat(s) to the mission. For the purposes of this guide, the environmental health professional shall identify the environmental health threats and AOC(s) in the deployment area.

6.4.1.1 The environmental health professional shall review the mission. This review should include the operations plan and the deployment plan.

6.4.1.2 Information gathered during predeployment activities may come from both classified and unclassified sources. Refer to specific intelligence sources identified in service-specific implementation guidelines.

6.4.1.3 The environmental health professional shall assemble readily available information regarding the mission location. This information may be collected from interviews, electronic databases, or other sources. Other sources include, but are not limited to, maps, satellite, and other remotely sensed data and imagery; theater location reports; background documents prepared by Armed Forces Medical Intelligence Center (AFMIC); or other government and nongovernmental organizations.

6.4.2 The environmental health professional shall describe the deployment area. The deployment area is generally defined as the lateral, forward, and rear boundaries assigned to a commander. The deployment area goes beyond the boundary of deployment site. The deployment area boundaries will depend on the information collected about potential environmental health threats and can be expanded at the discretion of the environmental health professional.

6.4.3 The environmental health professional should describe the deployment area's impacts on the mission. Specifically, the environmental health professional should describe

how the environmental health threats and AOC, including weather, climate, terrain, and topography could affect the accomplishment of the mission.

6.4.4 The environmental health professional should evaluate the environmental health threats and AOC in light of his/her current level of information and reevaluate these threats, as new information becomes available.

6.4.5 The environmental health professional shall develop a CSM early in the predeployment process. The purpose of building the CSM is to identify and, if possible, eliminate or mitigate potentially complete exposure pathways; document known potentially complete exposure pathways; and identify known data gaps. The CSM is dynamic and may evolve during the mission as goals, objectives, or conditions change.

6.4.6 *Identifying Complete and Potentially Complete Exposure Pathways*—Potential exposure routes through groundwater, surface water, air, soils, sediments, biota, including vectors or infectious agents or both if they are not specifically covered by other assessments should be identified for each environmental health threat. Complete exposure pathways should be identified and distinguished from potentially complete exposure pathways. An exposure pathway is incomplete if any of the following elements are missing: (1) a mechanism of environmental health threat release from primary or secondary sources, (2) a transport medium if potential environmental receptors are not located at the source, and (3) a point of potential contact of deployed personnel with the environmental health threat. The potential for both current and future releases and migration of the environmental health threats along the complete exposure pathways to the environmental receptors should be determined. A table, chart, or other visual/graphic representation of exposure pathways for all environmental health threats identified at a deployment site should be generated. This information should be documented and consistent with the narrative portion and tables in the preliminary hazard assessment to facilitate the use of the information for exposure or risk assessment. Defining environmental health threat migration from sources to deployed personnel is an important application of the CSM.

6.5 The CSM identifies both the environmental health threats and the exposure pathways for human receptors that may be present at the deployment site. Exposure pathways that are identified at the deployment site include complete and potentially complete exposure pathways. The CSM should include a graphic depiction such as a map or a diagram indicating the estimated or actual physical boundaries of AOC within which deployed personnel may encounter the environmental health threats or migration pathways; separate representations may be prepared to illustrate specific environmental health threats or groups of environmental health threats. The CSM must be reevaluated as new data becomes available to the environmental health professional. This new data may include analytical results from soil, water, groundwater, or air samples collected at the deployment site. The following is a list of media that should be considered when evaluating whether or not complete or potentially complete exposure pathways are