



Standard Guide for Environmental Health Site Assessment Process for Military Deployments¹

This standard is issued under the fixed designation E 2318; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

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.*

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*,

¹ This guide is under the jurisdiction of ASTM Committee E50 on Environmental Assessment, Risk Management and Corrective Action and is the direct responsibility of Subcommittee E50.05 on Environmental Risk Management. Current edition approved Oct. 1, 2003. Published December 2003.

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

DI-1816-6-99, *Medical Intelligence Assessment of Deployment Environmental Health Risks*, January 1999

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 troop movement

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. Under

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

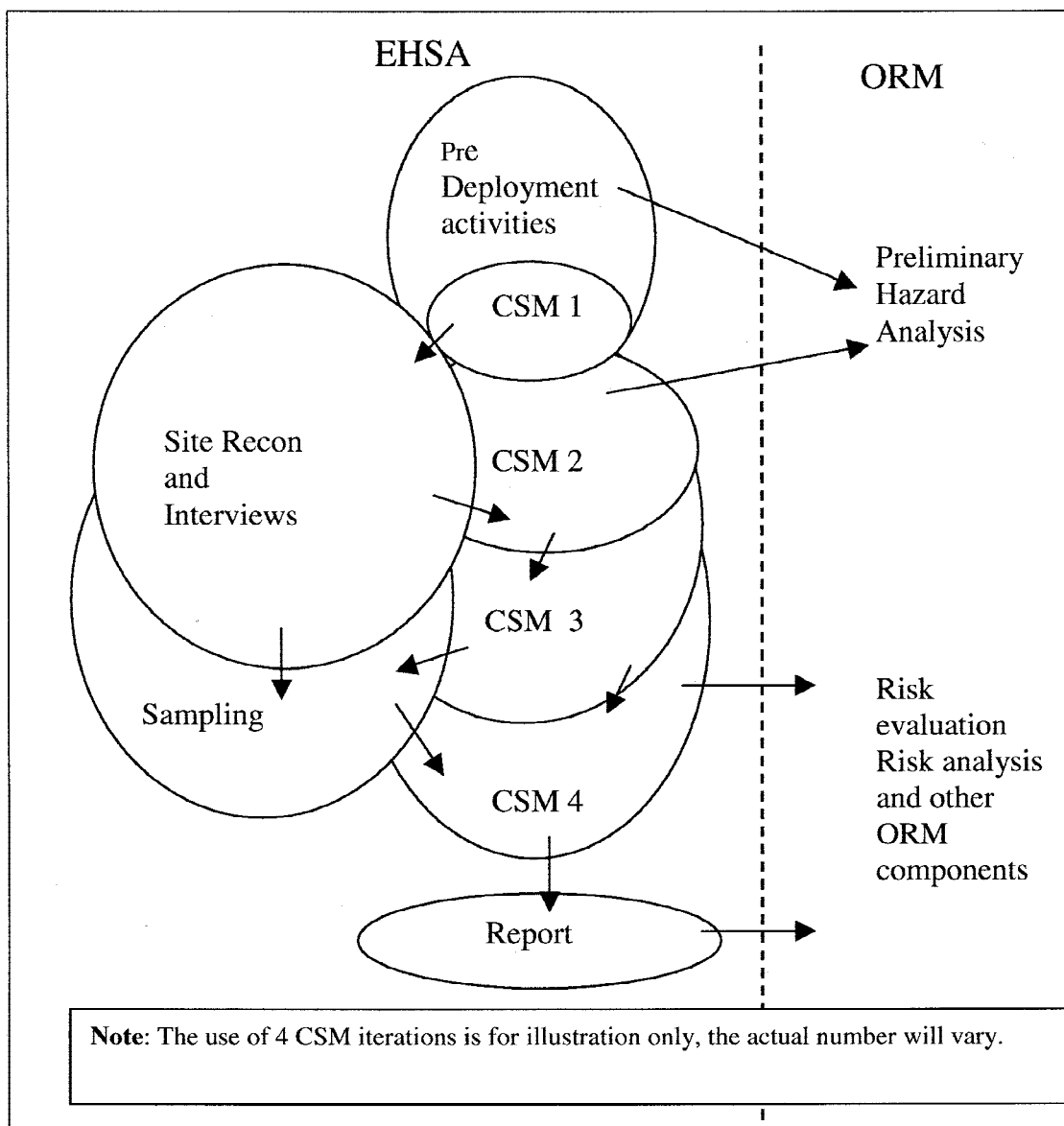


FIG. 1 EHSA Process Illustrating the Iterative Process of the Conceptual Site Model

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 a crude 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

present at the deployment site. These media do not need to be considered unless the CSM indicates a potentially complete exposure pathway.

6.5.1 *Groundwater*—Groundwater should be considered if it will be used as a potential drinking water source or may be contacted as part of another complete or potentially complete exposure pathway. Movement of water through the vadose zone need only be considered if it is part of a complete or potentially complete exposure pathway. An example would be when trenching is planned in an area with a seasonal water table near the surface of the soil. If information gathered during predeployment activities, or from other credible sources, indicates that contamination may be moving from a nearby source in the groundwater and in the saturated zone above the groundwater and trenching may result in direct contact of deployed personnel through air, water, and/or soil, then these pathways should be considered. If the water table is well below the surface of potential trenching, then the vadose zone is of no concern and need not be considered.

6.5.2 *Surface Water and Sediment*—Surface water and sediment should be investigated if the water will be used as a source of drinking water or for recreational purposes.

6.5.3 *Air*—Air should be evaluated for environmental health threats. The migration of environmental health threats from air to other environmental media should be considered. For example, deposition of particulates, resulting from incineration onto surface waters and soil. Consideration of environmental health threats from adjacent sites (for example, refineries, smelters, or mining operations) that emit dust, fumes, gases, or particulates that may present threats from dermal contact, ingestion, and/or inhalation should be evaluated on a case-by-case basis.

6.5.4 *Soil Contact*—Soil contact should be evaluated if environmental health threats from dermal absorption or radioactively contaminated soil may come into direct contact with deployed personnel. There is a potential for deployed personnel to be exposed to environmental health threats at different soil depths. Depth factors and stratification should be considered when contaminated soils are being evaluated.

6.5.5 *Food Chain*—Bioconcentration and bioaccumulation in organisms and the resulting potential for transfer and biomagnification along food chains should be considered. This is most likely to be of concern if extensive use of locally procured food occurs.

6.5.6 *Biological Hazards*—Other biotic pathways such as insect vectors, endemic diseases, and venomous animals not related to hazardous materials are routinely evaluated by detailed and specific procedures not described in this guide. The primary concern is vector-borne disease, or those diseases that can be transmitted to humans by arthropods (insects, ticks, and mites). Also of concern are zoonotic diseases carried by vertebrate pests that can be transmitted to humans, such as leptospirosis and hantavirus. In addition to disease as discussed above, biological hazards also include those hazards associated with biting and stinging arthropods (fire ants, spiders, and scorpions), animals (rodents, birds, bats, and snakes), and poisonous plants (poison ivy/oak/sumac). These “nondisease” hazards can be important in any geographical area. The

environmental health professional should consider the potential impact of biological hazards during his/her predeployment activities if they are applicable and not addressed by other assessments. Actual biological assessments should be only performed by appropriately trained personnel. For specific procedures, see Technical Guide 288 and Armed Forces Pest Management Board’s *Guide to Entomological Surveillance During Contingency Operations*.

6.6 *Preliminary Hazard Assessment*—Information gathered and organized in the predeployment activities phase of the assessment may be used in completing a preliminary hazard assessment for ORM purposes. There is considerable overlap in the predeployment activity of this guide and the requirements under the ORM process for the preliminary hazard assessment. Information generated by the EHSA may be used as part of the overall risk assessment completed during the ORM process.

6.7 *Environmental Health Threat Identification:*

6.7.1 An environmental health threat is 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.

6.7.1.1 Chemical hazards can be associated with different media (for example, air, water, soil, and food) and exposure routes. Exposures can occur via inhalation of airborne chemicals as mists, vapors, gases, or solids (fumes or dusts). Exposure can also occur via ingestion of drinking water or the inadvertent ingestion of soil. Dermal contact with some chemicals can also be a threat under some conditions. Identification of environmental health threats can include collection of information through intelligence channels, field sampling, exposure or accident modeling, or a combination of any of the methods.

6.7.1.2 Radiological hazards can be associated with different media (for example, air, water, soil, and food) and exposure routes. Exposures can occur via inhalation or ingestion, or both, of environmental media contaminated by radioactive materials. Dermal contact with some radiological hazards can also be a threat under some conditions. Identification of these environmental health threats can include collection of information through various information sources, field sampling, exposure, or accident modeling, or a combination of any of these methods. Exposures can occur through inhalation or ingestion, or both, of environmental media contaminated by radioactive materials (TG 236A may be an appropriate tool).

6.7.1.3 Biological hazards are associated with medically-significant pests (biting and stinging arthropods), rodents, snakes, and poisonous plants. Vector-borne and zoonotic diseases are highly variable and hard to predict because many variables interact together. These variables include such things as the life cycles of the pathogen, host, and vector; recent weather; and environmental conditions. As a result, the potential for exposure is constantly changing. The environmental health professional should consider the potential impact of biological hazards during his/her predeployment activities if they are applicable and not addressed by other assessments. Actual biological assessments should be only performed by appropriately trained personnel such as entomologists or other

applied biologists. If trained personnel are not available, Appendix X5 provides a useful tool to evaluate environmental health threats posed by biological hazards.

6.7.2 Using Field Data to Estimate Exposure—The environmental health professional should become familiar with the basis, assumptions, and limitations associated with complete and potentially complete exposure pathways and should also have sufficient training and experience to assess critically how representative field-collected sampling data is for characterizing potential exposures. In many cases, a limited number of samples will be obtained from the deployment site, and it will require significant professional judgment and assumptions to determine what potential exposures can be anticipated throughout the deployment. These assumptions should be adequately documented to enable comprehension of the assessment by other environmental health professionals.

6.8 Preliminary Hazard Assessment:

6.8.1 Preliminary Hazard Assessment (Report)—A preliminary hazard assessment is completed by reviewing relevant intelligence data, previous assessments, and/or other available data for the area of a military deployment to determine if potential environmental health threats exist to deployed forces. The preliminary hazard assessment can include information on the mission, adversary, terrain and weather, length of deployment, type of forces deployed, and the host nation population. 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 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.

6.8.2 The purpose of this step is to list and, when appropriate, prioritize the identified environmental health threats so that the preliminary hazard assessment can focus on the most important threats first. The environmental health risk assessment process is beyond the scope of this guide. The environmental health professional should be sufficiently trained in the ORM process to understand and prioritize effectively environmental health threats identified through the predeployment activities.

7. Site Reconnaissance and Interviews

7.1 Objective—The objective of site reconnaissance is to validate the information from pre-deployment activities and obtain additional information about complete or potentially complete exposure pathways associated with the deployment site.

7.2 Observation—On a visit to the deployment site (the site visit), the environmental health professional should visually and physically observe the deployment site and any structure(s) located on the site to the extent not obstructed by bodies of water, adjacent buildings, or other obstacles. In some cases, it may not be practical or possible for the environmental health professional to perform the site visit or conduct interviews. In such situations, they shall rely on other individuals under their supervision to perform the actual site visit. In all cases, it shall be the responsibility of the environmental health professional

to analyze the information obtained. The visual inspection guidance in Appendix X2 and the site assessment questions in Appendix X3 may be used where applicable.

7.2.1 Exterior—The periphery of the deployment site shall be visually or physically observed, as well as the periphery of all structures on the deployment site, and the deployment site should be viewed from all adjacent public thoroughfares. If roads or paths with no apparent outlet are observed on the deployment site, the use of the road or path should be investigated to determine whether it was likely to have been used as an avenue for handling or disposal of hazardous materials.

7.2.2 Interior—The interior of structures on the deployment site, including all reasonably accessible common areas (such as lobbies, hallways, utility rooms, recreation areas, and so forth), maintenance and repair areas, boiler rooms, and a representative sample of occupant spaces, should be visually or physically observed, or both. It is not necessary to look under floors, above ceilings, or behind walls.

7.2.3 Methodology—The method used to observe the deployment site (for example, grid patterns or other systematic approaches used for large properties) shall be documented in the report. The environmental health professional is encouraged to use documentation tools and military standardized forms applicable to the deployment mission such as depicted in the appendices.

7.2.4 Limitations—Limitations such as physical obstructions (adjacent buildings, bodies of water, asphalt, or other paved areas), limiting conditions (snow, rain), and any limitations imposed by the mission (time constraints and accessibility) shall be documented in the report.

7.2.5 Frequency—It is not expected that more than one visit to the site shall be made by the environmental health professional in connection with an EHSA. The one visit constituting part of the EHSA may be referred to as the site visit. This guide does not preclude multiple site visits to accommodate changes in mission or the discovery of new exposure pathways.

7.3 Prior Assessment Usage—The information supplied in connection with the site reconnaissance portion of a prior site assessment may be used for guidance. However, it shall not be relied upon without determining through new site reconnaissance whether any site conditions involving complete or potentially complete exposure pathways have changed since the prior environmental site assessment.

7.4 Uses and Conditions—The environmental health professional(s) conducting the site reconnaissance should document the uses and conditions described within this section to the extent that they are visually or physically observed, or both during the site visit. The type, uses, and conditions as outlined in this section should also be the subject of questions asked as part of site-related interviews. Uses and conditions to be noted shall be recorded in field notes of the environmental health professional(s) conducting the site reconnaissance. The environmental health professional(s) performing the environmental health site assessment is obligated to identify uses and conditions only to the extent that they may be visually or physically observed, or both on a site visit, as described in this guide, or

to the extent that they are identified by the interviews or predeployment activities described in this guide.

7.4.1 *General Site Setting:*

7.4.1.1 *Current Use(s) of the Deployment Site, Adjoining Properties, and the Surrounding Area*—The current use(s) of the deployment site, adjoining properties, and the surrounding area shall be identified in the report. This includes uses likely to involve the use, treatment, storage, disposal, or generation of hazardous materials. Unoccupied occupant spaces should be noted. In identifying uses of the site, information that is more specific is more helpful than less specific information. (For example, it is more useful to identify specific uses such as a hardware store or a steel mill rather than simply retail or industrial use.)

7.4.1.2 *Past Use(s) of the Site, Adjoining Properties, and the Surrounding Area*—To the extent that indications of past uses of the deployment site adjoining properties and the surrounding area are visually or physically observed or both during the site visit, or are identified in the interviews or predeployment activities, they shall be identified in the report. Past uses identified shall be described in the report if they are likely to have involved the use, treatment, storage, disposal, or generation of hazardous materials. (For example, there may be signs on a structure indicating a past use.) Uses identified shall be described in the report if they are likely to indicate complete or potentially complete exposure pathways in connection with the deployment site.

7.4.1.3 *Geologic, Hydrogeologic, Hydrologic, Meteorologic, and Topographic Conditions*—The above conditions associated with the deployment site shall be noted. If any information obtained shows that there are likely to be environmental health threats on the deployment site or on nearby properties and those environmental health threats are of a type that may migrate, these conditions shall be analyzed with respect to complete or potentially complete exposure pathways.

7.4.1.4 *General Description of Structures*—The report shall generally describe the structures or other improvements on the deployment site, for example, number of buildings, number of stories each, approximate age of buildings, ancillary structures (if any), and so forth.

7.4.1.5 *Roads*—Public thoroughfares adjoining the deployment site shall be identified in the report and any roads, streets, and parking facilities on the deployment site shall be documented.

7.4.1.6 *Potable Water Supply*—The source of potable water and any related treatment and distribution system components for the deployment site shall be identified in the report.

7.4.1.7 *Sewage Disposal System*—The sewage disposal system for the deployment site shall be identified in the report. Inquiry shall be made as to the age and condition of the system.

7.4.2 *Interior and Exterior Observations:*

7.4.2.1 *Current and Past Use(s) of the Site*—The use(s) of the deployment site shall be identified in the report. This includes both present and past uses likely to involve the use, treatment, storage, disposal, or generation of hazardous materials or other environmental health threats shall be identified in the report. Unoccupied occupant spaces shall be noted. To the

extent that indications of past uses of the deployment site are visually or physically observed or both on the site visit, or are identified in the interviews or predeployment activities, they shall be identified in the report. In identifying the uses of the deployment site, specific information is more helpful than generalized information. (For example, it is more useful to identify uses such as a hardware store, a grocery store, or a bakery rather than simply retail use.)

7.4.2.2 *Hazardous Materials in Connection with Identified Uses*—To the extent that activities or processes are identified that use, treat, store, dispose of, or generate hazardous materials on the deployment site: (1) the hazardous materials shall be identified or indicated as unidentified in the report and (2) the approximate quantities involved, types of containers (if any), and storage conditions shall be documented. To the extent that past uses are identified that used, treated, stored, disposed of, or generated hazardous materials on the deployment site, the information shall be identified to the extent it is visually or physically observed, or both during the site visit or identified from the interviews or the predeployment activities.

7.4.2.3 *Storage Tanks*—Aboveground storage tanks, underground storage tanks, vent pipes, fill pipes, or accessways indicating underground storage tanks shall be documented (for example, content, capacity, and age) to the extent visually or physically observed or both during the site visit or identified from the interviews or predeployment activities.

7.4.2.4 *Odors*—Strong, pungent, or noxious odors shall be documented and their sources shall be identified in the report to the extent visually or physically observed, or both, or identified from the interviews or predeployment activities.

7.4.2.5 *Pools of Liquid*—Standing surface water shall be noted. Pools or sumps containing liquids likely to be hazardous materials shall be documented to the extent visually or physically observed, or both, or identified from the interviews or predeployment activities.

7.4.2.6 *Drums*—To the extent visually or physically observed, or both, or identified from the interviews or predeployment activities, the presence of drums shall be documented, whether or not they are leaking, unless it is known that their contents are not hazardous materials (in that case the contents shall be documented). Drums often hold 55 gal (207 L) of liquid, but containers as small as 5 gal (19 L) should also be described.

7.4.2.7 *Hazardous Material and Petroleum Products Containers (Not Necessarily in Connection with Identified Uses)*—When containers identified as containing hazardous materials are visually or physically observed, or both on the site that may represent complete or potentially complete exposure pathways, the hazardous materials shall be identified or indicated as unidentified in the report. The approximate quantities involved, types of containers, and storage conditions shall be documented.

7.4.2.8 *Unidentified Substance Containers*—When open or damaged containers storing unidentified substances suspected of being hazardous materials are visually or physically observed or both on the deployment site, the approximate quantities involved, types of containers, and storage conditions shall be described in the report.

7.4.3 Interior Observations:

7.4.3.1 *Heating/Cooling*—The means of heating and cooling the buildings on the deployment site, including the fuel source for heating and cooling, shall be identified in the report (for example, heating oil, gas, electric, and radiators from steam boiler fueled by gas).

7.4.3.2 *Stains or Corrosion*—To the extent visually or physically observed, or both, or identified from the interviews, stains or corrosion on floors, walls, or ceilings shall be documented.

7.4.3.3 *Drains and Sumps*—To the extent visually or physically observed, or both, or identified from the interviews, floor drains and sumps shall be documented.

7.4.4 Exterior Observations:

7.4.4.1 *Pits, Ponds, or Lagoons*—To the extent visually or physically observed, or both, or identified from the interviews or predeployment activities, pits, ponds, or lagoons on the deployment site shall be documented, particularly if they have been used in connection with waste disposal or waste treatment. Pits, ponds, or lagoons on properties adjoining the deployment site shall be documented to the extent they are visually or physically observed, or both, from the site or identified in the interviews or predeployment activities.

7.4.4.2 *Stained Soil or Pavement*—To the extent visually or physically observed, or both, or identified from the interviews, areas of stained soil or pavement shall be documented.

7.4.4.3 *Stressed Vegetation*—To the extent visually or physically observed, or both, or identified from the interviews, areas of stressed vegetation (from something other than insufficient water) shall be documented.

7.4.4.4 *Solid Waste*—To the extent visually or physically observed, or both, or identified from the interviews or predeployment activities, areas that are apparently filled or graded by non-natural causes (or filled by material of unknown origin) suggesting trash or other solid waste disposal, or mounds or depressions suggesting trash or other solid waste disposal, shall be documented.

7.4.4.5 *Wastewater*—To the extent visually or physically observed, or both, or identified from the interviews or predeployment activities, wastewater or other liquid (including storm water) or any discharge into a drain, ditch, or stream on or adjacent to the deployment site shall be documented.

7.4.4.6 *Wells*—To the extent visually or physically observed, or both, or identified from the interviews or predeployment activities, all wells (including dry wells, irrigation wells, injection wells, abandoned wells, or other wells) shall be documented.

7.4.4.7 *Septic Systems*—To the extent visually or physically observed, or both, or identified from the interviews or predeployment activities, indications of on-site septic systems or cesspools should be described in the report.

7.5 *Sampling Issues*—The site reconnaissance portion of the environmental health site assessment may include sampling activities. These are addressed in Section 8.

7.6 *Site Reconnaissance Interviews with Credible Knowledgeable Individuals:*

7.6.1 *Objective*—The objective of interviews is to obtain information indicating complete or potentially complete expo-

sure pathways in connection with the deployment site. The persons interviewed may include owners, occupants, health and safety officials, members of the deployed force, U.S. Embassy officials, and others. Under some conditions, the mission may limit the ability of the environmental health professional to conduct interviews with credible knowledgeable individuals. Such limitations shall be documented. When documented, such limitations shall not preclude the environmental health professional from meeting the requirements of this guide.

7.6.2 *Content*—Interviews with credible knowledgeable individuals consist of questions asked in the manner and of persons as described in this section. The content of these questions shall attempt to obtain information about uses and conditions of the deployment site and surrounding area as they relate to complete or potentially complete exposure pathways in connection with the deployment site.

7.6.3 *Medium*—Questions asked pursuant to this section may be asked in person, by telephone, or in writing, at the discretion of the environmental health professional. If feasible, interviews should be conducted in conjunction with the site reconnaissance.

7.6.4 *Timing*—It is at the discretion of the environmental health professional whether to ask questions before, during, or after the site visit or in some combination thereof.

7.6.5 *Who Should Be Interviewed:*

7.6.5.1 *Credible Knowledgeable Individuals*—The environmental health professional should attempt to identify credible knowledgeable individuals before the site visit. This may be accomplished through a variety of ways and is at the discretion of the environmental health professional. For example, the host nation representative may be asked to identify a person with good knowledge of the uses and physical characteristics of the deployment site. Often such an individual can be the property manager, health or safety official, or a maintenance person responsible for the site. It is within the discretion of the environmental health professional to decide which questions to ask and whom to ask. The questions in Appendix X2 may be used where applicable.

7.6.5.2 *Occupants*—If in the environmental health professional's judgment an interview with occupants is likely to provide additional and useful information, a reasonable attempt should be made to interview a selected number of occupants familiar with the uses of the property that may be useful in identifying complete or potentially complete exposure pathways associated with the deployment site.

(1) *Multifamily Properties*—For residential properties, residential occupants do not need to be interviewed, but if the property has nonresidential uses, to the extent possible, interviews should be held with the nonresidential occupants concerning complete and potentially completed pathways associated with the deployment site.

(2) *Reasonable Attempts to Interview*—Examples of reasonable attempts to interview include (but are not limited to) an attempt to interview credible knowledgeable individuals when making the site visit or calling the credible knowledgeable individuals by telephone. In any case, when there are several credible knowledgeable individuals to interview, it is not

expected that the site visit must be scheduled at a time when they will all be available to be interviewed.

(3) *Occupant Identification*—The report shall identify the credible knowledgeable individuals interviewed and their affiliation with the deployment site.

7.6.6 *Quality of Answers*—The person(s) interviewed should be asked to be as specific as possible in answering questions. The person(s) interviewed should be asked to answer in good faith and to the extent of their actual knowledge.

7.6.7 *Incomplete Answers*—While the person conducting the interview(s) has an obligation to ask questions, in many instances the persons to whom the questions are addressed will feel no obligation to answer them. If the person conducting the interview(s) asks questions but does not receive answers or receives partial answers, this section of the environmental health site assessment shall not be deemed incomplete, provided that the questions have been asked and documented.

7.6.8 *Questions About Helpful Documents*—Before the site visit, the credible knowledgeable individuals (if any are identified), should be asked if they know whether any of the documents such as those listed in 7.6.8.1 exist and, if so, whether copies can and will be provided to the environmental health professional within reasonable time and cost constraints. Even partial information provided may be useful. If so, the environmental health professional conducting the site visit shall review the available documents.

7.6.8.1 *Helpful Documents*:

- (1) Environmental site assessment reports,
- (2) Environmental audit reports,
- (3) Environmental permits (for example, solid waste disposal permits, hazardous waste disposal permits, wastewater permits),
- (4) Registrations for underground and aboveground storage tanks,
- (5) Material safety data sheets,
- (6) Safety plans; preparedness and prevention plans; spill prevention, countermeasure, and control plans; and so forth,
- (7) Reports regarding hydrogeologic conditions on the property or surrounding area,
- (8) Notices or other correspondence from any government agency relating to past or current violations of environmental laws with respect to the property or relating to environmental liens encumbering the property,
- (9) Hazardous waste generator notices or reports,
- (10) Geotechnical studies, and
- (11) Pesticide use records.

7.6.9 *Proceedings Involving the Property*—The credible knowledgeable individuals (if any are identified), should be asked whether they know of any administrative proceedings relevant to hazardous materials with respect to the deployment site or any notices from any governmental entity regarding any possible violation of environmental laws or possible incidents relating to the release of hazardous materials.

8. Sample Collection

8.1 The purpose of this section is to discuss the philosophy of sample collection. Detailed guidance on actual sample collection can be found in the referenced documents listed in

Section 2. The actual process of sample collection, the number and types of samples collected, and the type of analysis performed on the samples will vary with the mission and the service's protocols and are not specifically detailed in this guide. Samples are collected to confirm possible exposure pathways identified in the conceptual site model. Environmental sampling during a military deployment is primarily performed to protect Service personnel from exposures to environmental health threats that may cause acute or chronic health effects.

8.2 Environmental data related to the EHSA include but are not limited to results from sampling and analysis of air, soil, water, or hazardous material samples or any combination thereof. Sampling programs conducted as part of an EHSA will differ from traditional site characterization and environmental background sampling in several ways.

8.2.1 Sampling programs can involve a much broader range of potential environmental health threats including such things as chemical, radiological, and biological exposures.

8.2.2 Sampling is generally restricted to evaluation of exposure pathways associated with AOC identified in the CSM and not typically concerned with delineation of contaminants for future corrective action decisions such as site remediation.

8.2.3 Deployment decisions related to exposures and risks are based on substantially different exposure models than traditional risk evaluation since the exposed population characteristics are different and the duration of exposure may be limited.

8.2.4 CSM, exposure pathways, and sampling program designs are all focused on human health exposure, not regulatory compliance, site characterization, or ecological risk concerns.

8.2.5 Sampling plans are biased to select samples with a high probability of detection and for the specific purpose of addressing AOC identified in the CSM. Data generated by such biased sampling should be used with caution for any other analysis regarding environmental receptor exposure or general site characterization.

8.2.6 Sampling and the subsequent data generated will often be spontaneous and conducted using an extemporaneous sampling plan. The only documentation of the sample collection until the final report may be contemporaneous notes.

8.2.7 The need for sampling can be eliminated if exposure pathways can be eliminated by some other action. For example, relocation of proposed facilities and denying use of and posting restricted areas may eliminate the need for sampling because other physical steps to remove or block the exposure pathway were instituted.

8.2.8 Mission objectives may impose restrictions on data collection and analysis. The role of the environmental health professional is to advise the commander using the best available information.

8.2.9 In initial or short-term deployments, there may be very little actual site information upon which to base a sampling collection activity. Sampling in this situation may be used to provide basic information to construct or possibly validate an initial and untested CSM. The initial CSM will go through several iterations if significant environmental health threats are

discovered or as the size or duration of the deployment increases. In situations more typical of a long-term deployment, there may be significant information on the environmental health threats and prior use of the site. The sampling in these cases is simply to refine the CSM; evaluate potential exposure pathways, vectors, or transport mechanisms; and to develop an appropriate risk management plan.

8.3 *Data Quality Objectives (DQO(s))*—The development of DQOs is the first of a three-part data generation activity. The other two are: implementation of the sampling and analysis strategy and data quality assessment.

8.3.1 The DQO process results in the development of data quality objectives (DQOs) for the acquisition of environmental data. Optimization of sampling and analysis design is part of the DQO process. DQOs clarify the sampling objectives, define the most appropriate data to collect, determine the most appropriate conditions from which to collect the data, and establish acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support the decision. They are used to develop a sampling and analysis design.

8.3.2 The impacts of a successful DQO process on the assessment activities are as follows:

8.3.2.1 A consensus on the nature of the problem and the desired decision shared by all decision makers,

8.3.2.2 Data quality consistent with the intended use,

8.3.2.3 A more resource efficient sampling and analysis design,

8.3.2.4 A planned approach to data collection and evaluation,

8.3.2.5 Quantitative criteria for knowing when to stop sampling, and

8.3.2.6 Known measure of risk in making an incorrect decision.

8.3.2.7 DQOs are discussed in more detail in the referenced documents and service-specific guidance.

8.3.3 *Data Quality Level*—The reliability of results is related to the data quality level of the method used. Selection of field or laboratory analytical methods should be based in part on the environmental health threat, or indicator compounds of interest, the intended use of the data, and the capability of the method. For example, lower quality methods (often called field-screening methods) may be used for source identification, while higher data quality methods should be used to delineate environmental health threats at lower detection limits. Both quantitative and qualitative field analytical methods can be used to acquire data necessary to evaluate the AOC or to develop future action plans. When determining what level of data quality is most appropriate, the following should be considered:

8.3.3.1 The quality level selected should be consistent with the purpose and scope of the EHSA and the intended use of the data.

8.3.3.2 Many points containing lower quality level data may provide a better understanding of site conditions than a few data points at a higher data quality level.

8.3.3.3 Military exposure guidelines should be considered with respect to the quantification limits of analytical instru-

ments. This is particularly important when using field detection instruments (for example, photoionization detection equipment).

8.3.3.4 *Limitations*—All analytical methods and instruments have limitations that may affect results. These limitations include the effect of temperature or humidity, cross-sensitivity issues, and masking of certain constituents. In addition, the operational expertise of the person performing the analysis may also affect the results. These limitations should be considered when selecting analytical methods or instruments.

8.3.3.5 *Method Protocol and QA/QC Considerations*—Each analytical method has a standard protocol established by either the U.S. Environmental Protection Agency (USEPA), a state regulatory agency, or an industry consensus group or manufacturer or has a DoD protocol specifically developed for use during deployments.

(1) Before performing the analysis, method protocol and quality control procedures should be developed and documented in a quality control plan. A method quality control plan should specify the following as appropriate: instrument calibration procedures; generation of calibration curves; preparation and analysis of field standards; analysis of matrix spikes, matrix spike duplicates, blanks, and control samples; frequency for instrument calibration and quality control sample analysis; and acceptable criteria for results of instrument calibration and quality control samples.

(2) Field-generated data will typically have less rigorous QA/QC requirements with regard to the criteria listed above. As part of a QA/QC review, field-generated data should be evaluated for: completeness of the field reports and records; identification of invalid samples; correlation of field test data; and identification of anomalous field-generated data. A review of the field records will often allow an experienced environmental health professional to determine the validity and usefulness of field-generated data.

(3) Follow the service-specific guidance documents.

8.3.3.6 The environmental health professional is responsible for the quality control associated with the sampling plan. The person actually collecting the samples must be familiar with the sample plan and ensure that the sampling methods are being performed and the field screening samples are being analyzed in accordance with the plan. The results of the quality control sample analysis should be recorded and reviewed as the data is being generated as well as during data evaluation and refining of the conceptual site model. Quality control procedures and analytical results should be considered in developing the assessment for the commander.

8.4 *Sampling Plan*—The sampling plan should be appropriate for the mission. The level of detail will vary widely depending upon the nature of the deployment. It may be appropriate to have only a verbal briefing before a rapid short-term deployment. The purpose of the briefing (sampling plan) is to define environmental health threats identified in predeployment review and specify the appropriate field analysis. A long-term deployment may require a detailed monitoring plan and description of the various quality control sampling protocols. Sampling plans are discussed in detail in the referenced documents and service-specific guidance.

8.5 *Data Collection Methods*—The selection of sampling tools should be based on the following:

- 8.5.1 Purpose and anticipated scope of the investigation,
- 8.5.2 Capabilities and limitations of each tool,
- 8.5.3 Speed by which samples can be obtained,
- 8.5.4 Advantages of using a combination of tools,
- 8.5.5 Site features and layout,
- 8.5.6 Anticipated geographic site conditions,
- 8.5.7 Anticipated agents or chemical(s) of concern and concentrations,
- 8.5.8 Difficulty in repeating the sample event or follow up sampling, and
- 8.5.9 Anticipated next steps.

8.6 *Field Activities*—The environmental health professional is responsible for the overall sampling mission. Responsibility may be split between the environmental health professional and personnel in the field. The individual in the field is responsible for all of the sampling, analyses, and documentation that can be performed using their direct reading equipment. They are also responsible for collecting and shipping samples for further analysis.

8.6.1 The field activity organization shall be such that each participant has an understanding of their duties and responsibilities and the relationship of those responsibilities to the total effort.

8.6.2 The environmental health professionals are responsible for establishing organizational, operational, health, and safety and QA policies. They shall ensure that the following requirements are met: (1) appropriate methodologies are followed; (2) personnel clearly understand their duties and responsibilities; (3) deviations from the sampling plan, DQOs, SOPs, or other project-planning documents are documented and communicated to the appropriate personnel; and (4) communication between the field, laboratory and the environmental health professional occur as specified in the project planning documents.

8.6.3 The quality assurance function is to ensure that field activity conforms to the project-planning documents. The person responsible for quality assurance should be independent of personnel engaged in the work being monitored.

8.6.4 Each member participating in the field activity shall possess the education, training, technical knowledge, and experience to perform their assigned functions.

8.7 *Field Analysis*—Field analytical methods are used to analyze soil, soil vapor, groundwater, or air, or a combination thereof. On-site analysis for environmental health threats allows the on-site personnel to determine the location of or need for additional samples. Field analytical methods can typically provide more data at lower cost with minimal sample disturbance than sending samples to an off-site laboratory. Key considerations in selecting field analytical methods are as follows:

8.7.1 *Analyte*—The analytical method(s) selected will depend on the environmental health threat being investigated. It may be necessary to use either field analytical methods capable of providing chemical-specific results or a combination of methods capable of analyzing a broader suite of compounds.

8.7.2 *Media*—Consideration must be given to the targeted sample media (soil, soil vapor, groundwater, and air) and the method's capability of measuring concentrations of the environmental health threat in that medium. The performance of field analytical methods will vary depending on the sample preparation required for the media being analyzed (especially for soil analyses).

8.8 *Collection and Analysis of Data*—Field records provide documentation for the necessary technical interpretation and judgments regarding exposure pathways.

8.8.1 Field records generally consist of bound field notebooks, sample collection forms, sample location maps, calibration forms or documentation, chain of custody forms, and any other relevant documentation.

8.8.2 As samples are acquired, it is important to document the person taking the sample, sample number, location (using MGRS if possible), equipment, type of sample (that is, potable water, raw water, soil, air, wipe, and so forth), climatic conditions, documentation of adherence to protocol, and any unusual observations. It shall also be noted why the sample is being collected. This is especially important to document how the sample relates to an area of concern when it is not a sample documented in a formal sampling plan.

8.8.3 Records shall be legible and reasonably protected against damage, deterioration, or loss.

8.8.4 As data is collected and analyzed, it may be necessary to adjust the data collection and analysis program to refine the CSM and satisfy the purpose of the EHSA.

8.9 *Evaluation of Data and Refinement of the CSM*—Analytical data collected during the field investigation shall be periodically interpreted by the environmental health professional or the personnel in the field. As shown in the flowchart in Fig. 1, the CSM is refined in an iterative process of data collection and evaluation.

8.9.1 Compilation of the data into simple graphics is essential for on-site data interpretation. This can be done by updating the maps, diagrams, or cross sections prepared to develop the initial CSM. As the investigation proceeds, the CSM should be continually revised, by incorporating the new data. Using the field-generated graphics, the environmental health professional directs the investigation to fill in data gaps or resolve differences between anticipated and actual results, or both. As new data are collected and the assessment proceeds, variances between the initial CSM and the data obtained can be used to adjust the sampling and analysis program in an iterative, scientific manner. This should occur until there is sufficient information about the environmental health threats in air, soil, and groundwater or surface water to resolve the concerns regarding complete or potentially complete exposure pathways.

8.9.2 The degree of detail and accuracy of the graphical representation of site conditions varies according to the purpose of the investigation, complexity of the deployment site, and the characteristics of the environmental health threats. If multiple measurements are made and the amount of information that describes more complex conditions increase, the site data can be compiled on graphical software.

8.10 *Data Validation*—To ensure that it is useful, field- and laboratory-generated data must be validated. Considerations for data validation include the following:

8.10.1 Quality assurance/quality control (QA/QC) results (for example, duplicates, multipoint calibration curves, calibration checks, blanks, and so forth),

8.10.2 Comparison of higher quality level data to check lower quality level data,

8.10.3 Consistency of results among analytical methods and sampling techniques,

8.10.4 Comparison with results from other media,

8.10.5 Comparison with other chemical(s) of concern or indicator compounds,

8.10.6 Comparison against previous data, if available, and

8.10.7 The data should make sense in the context of the site conditions and previously generated data.

8.10.8 Once the validity of the data has been assessed, it can be used to determine whether data quality objectives have been satisfied.

9. Conceptual Site Model

9.1 The CSM is defined as a 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. The CSM identifies the environmental health threats and the exposure pathways at the deployment site. Development of the CSM is an iterative process. The quality of the information being assembled should be evaluated, preferably including quantitative methods, and the decision to use the information should be based on the data's meeting objective qualitative and quantitative criteria. Methods used for obtaining analytical data should be described, and sources of information should be referenced. CSM(s) should be developed for every deployment site unless there are multiple sites in proximity to one another such that it is not possible to determine the individual source or sources of environmental health threats. Sites may be aggregated in that case. A CSM should then be developed for the aggregate. On many larger deployment sites, there will be multiple CSM for various AOC.

9.1.1 *Identifying Environmental Health Threats*—Identify environmental health threats in the groundwater, surface water, soils, sediments, biota, and air. Environmental health threats related to geographic setting (for example, altitude, heat, cold, water quality, and biological) should also be evaluated. If no environmental health threats are found, the conceptual site model should be used to help document this finding.

9.1.2 *Characterizing Sources*—At a minimum, the following environmental health threat characteristics should be identified:

9.1.2.1 The source, location(s), and, if appropriate, the boundaries and the volume(s) of chemical contaminants. Environmental health threats should be represented accurately on site maps using MGRS information if available. Maps should include a scale and direction indicator (for example, north arrow). The maps should furthermore show where the environmental health threat(s) is located in relationship to the deployment area/mission boundaries.

9.1.2.2 The concentration of hazardous constituents in the environmental medium of concern shall be identified for environmental health threats that are chemical in nature.

9.1.2.3 The conditions of exposure (for example, duration, route of exposure, and so forth) shall be identified for each identified environmental health threat.

10. Evaluations and Report Preparation

10.1 *Report Format*—The report of findings for the EHSA should generally follow the recommended report format as it appears in Appendix X3. Depending on the scope of the mission, the report may be presented in a format of CSM diagrams and tables with adequate explanation and documentation of the figures and tables (see Fig. 2 and Table 1). As operations allow, the environmental health professional may report the assessment results to local medical units and the Joint Task Force Surgeon. Copies of reports must also be submitted to the Deployment Environmental Surveillance Program at the U.S. Army Center for Health Promotion and Preventive Medicine and the component service's Health Surveillance Center (Air Force—AFIERA, Navy/Marine Corps—NEHC).

10.2 *Documentation*—The findings, conclusions, discussions, and recommendations in the EHSA report shall be supported by documentation. If the environmental health professional has chosen to exclude certain documentation from the report, the environmental health professional shall identify in the report the reasons for doing so (for example, a security classification of an information source). Supporting documentation shall be included with the report or adequately referenced to facilitate a fundamental understanding of the assessment by an environmental health professional other than the environmental health professional that conducted it. Sources that revealed no findings shall also be documented. Documentation can be provided in the body of the report or in an appendix.

10.3 *Executive Summary*—The executive summary should be prepared in issue/point paper format including prioritized list of health/mission issues from the EHSA. The executive summary should contain the preferred and at least one secondary remedial alternative and/or recommended courses of action for each environmental health threat with health/mission significance.

10.4 *Introduction*—The introduction section should describe the scope of the mission in sufficient detail to permit users to comprehend the work performed. It should describe the purpose, methodology used, limitations, and include any assumptions.

10.5 *Site Description*—The report should include sufficient detail on the deployment site and vicinity characteristics such as physical setting information, description of structures, roads, drinking water sources, waste disposal practices, and improvements.

10.6 *Information Sources*—The report should include a description of sources used and persons consulted/interviewed during predeployment activities and site reconnaissance. The source documentation can be provided in the body of the report or in an appendix.

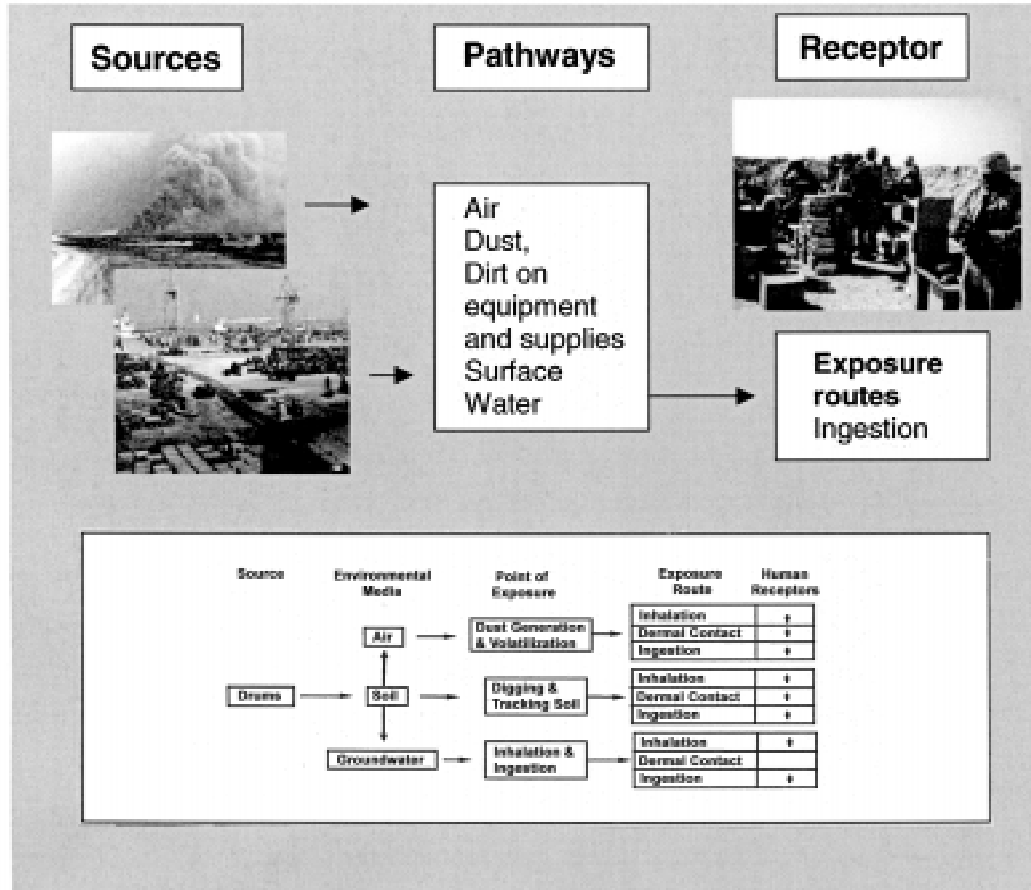


FIG. 2 Example of a Conceptual Site Model—Exposure Pathway Diagram

TABLE 1 Example of a Worksheet for a Conceptual Site Model

Receptor Population Potentially Exposed	Pathway, Medium, and Route of Exposure	Pathway Selected for Evaluation?	Reason for Selection or Non-Selection
Deployed personnel	Indoor inhalation of air particulates	Yes	Contaminated air from outside can enter indoor environments
Deployed personnel	Inhalation (vapors and particulates) and dermal contact and ingestion of surficial soil	Yes	Activities will generate dust and dirt on site creating potential for inhalation and dermal contact
Deployed personnel	Leaching to groundwater from surficial soil	No	Ground water will not be utilized at the site
Deployed personnel	Indoor inhalation of vapor emissions from subsurface soil	No	Subsurface soil under the building is not contaminated
Deployed personnel	Dermal contact and ingestion with subsurface soil	Yes	Personnel may directly contact surface soil during excavation activities at the site
Deployed personnel	Indoor inhalation of vapor emissions from groundwater	No	The groundwater plume is not under the building
Deployed personnel	Ingestion of groundwater	No	No drinking water well on-site

10.7 *Information from Site Reconnaissance and Sampling Activities*—The report should provide description of relevant information gained from the site reconnaissance and sampling activities (if performed) as described in Sections 7 and 8 of this guide.

10.8 *Findings*—The report shall have a findings section that summarizes known or suspect environmental conditions of health/mission significance associated with the AOC at the deployment site related to complete or potentially complete exposure pathways. Findings are the facts uncovered during the course of the environmental assessment. All findings concerning environmental conditions that may pose an environmental health threat to deployed personnel, affect the

intended mission, or both, should be reported. The general guiding principle is that the commander must make a decision about environmental conditions at a specific site that could affect the mission. Findings that will aid in that decision-making process should be reported.

10.9 *Conclusions*—The report shall include the environmental health professional’s conclusion(s) about known or suspect environmental health threats that may affect the health of deployed personnel. The logic and reasoning used by the environmental health professional in evaluating information collected during the course of the investigation shall be discussed. The conclusions shall specifically include the environmental health professional’s rationale for concluding that a

known or suspect environmental health threat associated with an identified AOC is or is not a complete or potentially complete exposure pathway. The conclusions are based on the evaluation of the findings. They are determinations that potential health risks to deployed forces or potentially mission-compromising environmental conditions exist or do not exist at a site. A conclusion can be a determination that no environmental conditions exist that pose health risks or could affect the accomplishment of the mission.

10.10 *Discussion*—The report may include an optional discussion section to describe the impact of conclusions based on quantitative and qualitative data collected during the EHSA. It may include information from the screening health risk assessment performed as part of the ORM process. Familiarity with service guidance such as the U.S. Army Center for Health Promotion and Preventive Medicine Technical Guide 230 and TG 248 are recommended. The level of detail and the extent of the analysis may vary based on the training and experience of the environmental health professional performing the analysis. The environmental health professional may choose to consult with other environmental health professional(s) to assist with development of any discussion. The information gathered in the EHSA process is incorporated into the ORM process to assist the commander's risk management decision making by evaluating the impact of environmental health threats. The EHSA discussion section can be a reference to the appropriate ORM documentation or may be a stand-alone description of the known information.

10.11 *Recommendations*—The report shall include a recommendations section that provides recommended courses of action that are options for reducing, mitigating, and/or eliminating the potential environmental health threat impacts posed by the complete or potentially complete exposure pathways

identified through the EHSA process. Recommended courses of action can range from taking no action to continued monitoring or, if the potential impact is severe enough, relocating of activities or equipment to minimize impacts. A number of options are generally available depending on the mission and associated risk tolerance of the specific commander. The environmental health professional should provide the commander(s) with a selection of recommended courses of action as opposed to recommending a single strategy. This enables the commander to evaluate options and select the appropriate strategy given the mission. Recommended courses of action should be formulated in a mission context and supported by scientifically defensible data.

10.12 *Assumptions*—Any assumptions that were made in the introduction section should be listed individually and discussed in this section of the report.

10.13 *Deviations*—All deletions and deviations from this guide (if any) shall be listed individually and in detail and all additions should be listed in this section of the report.

10.14 *References*—The report shall include a reference section to list references used in preparing the environmental health site assessment. Each referenced source shall be adequately annotated in an appendix to the report.

10.15 *Signature*—The environmental health professional(s) responsible for the environmental health site assessment shall sign the report.

10.16 *Appendices*—The report shall include an appendix section containing supporting documentation.

11. Keywords

11.1 conceptual site model; environmental exposure; environmental health site assessment; military deployment

APPENDIXES

(Nonmandatory Information)

X1. VISUAL INSPECTION GUIDE

X1.1 Note the types of containers, impoundments, and/or other storage systems:

X1.1.1 Metal or plastic barrels or drums.

X1.1.2 Underground tanks.

X1.1.3 Aboveground tanks.

X1.1.4 Compressed gas cylinders.

X1.1.5 Pits, ponds, or lagoons.

X1.1.6 Paper or wood packages and containers.

X1.2 Note any information on tags, labels, markings, or other identifying indicators.

X1.3 Note the condition of all waste containers and storage systems:

X1.3.1 Undamaged.

X1.3.2 Visibly rusted or corroded.

X1.3.3 Leaking or bulging.

X1.3.4 Size and type of container.

X1.3.5 Labels on containers indicating corrosive.

X1.3.6 Explosive, flammable, radioactive or toxic materials.

X1.4 Note the physical condition of the materials:

X1.4.1 Gas, liquid, or solid.

X1.4.2 Color and turbidity.

X1.4.3 Behavior; for example, foaming, crystallizing, vaporizing, or corroding.

X1.4.4 Conditions conducive to splash or other means of contact.

X1.5 Identify structures and general site conditions:

X1.5.1 Buildings.

X1.5.2 Sheds.

X1.5.3 Roads, paths.

X1.5.4 Fences.

X1.5.5 Ground cover.

X1.5.6 Condition of site structures.

X1.5.7 Obstacles to entry and exit.

X1.5.8 Terrain homogeneity.

X1.5.9 Terrain stability.

X1.5.10 General conditions of containers.

X1.5.11 Metal protruding from the ground or other surfaces.

X1.6 Determine the potential environmental media/transport mechanisms associated with the pathways of exposure:

X1.6.1 Air.

X1.6.2 Soil.

X1.6.3 Surface water.

X1.6.4 Groundwater.

X1.7 Note any indicators of past or ongoing environmental release:

X1.7.1 Dead fish, animals or vegetation.

X1.7.2 Dust or spray in the air.

X1.7.3 Fissures or cracks in solid surfaces that reveal buried waste layers.

X1.7.4 Pools of liquid.

X1.7.5 Gas generation or effervescence.

X1.7.6 Deteriorated or leaking containers.

X1.7.7 Cleared land areas representing possible landfill areas.

X1.7.8 Subsiding areas or other anomalous topography indicating possible waste burial locations.

X1.8 Identify any potentially radioactive, reactive, incompatible, flammable, or highly corrosive materials or wastes.

X2. SITE ASSESSMENT QUESTIONNAIRE GUIDE

X2.1 When the tactical or logistic situation, or both permits, host nation representative or other credible knowledgeable individuals, or both, should be interviewed to build a conceptual site model of the deployment site. Ensure that the individual's name, agency affiliation, and the date of the interview are included in the report. The following questions in Table X2.1 serve as a starting point for gaining information

about environmental conditions that exist at a site. Within the constraints cited above, they should be asked of all persons who may possess useful knowledge about the deployment site.

TABLE X2.1 Site Assessment Questionnaire

Questions	Yes	No	Unknown
To the best of your knowledge, is the site or any adjoining site now or ever been used for an industrial purpose or use likely to be associated with generation handling of disposal of hazardous materials? If the answer is affirmative, document specific use(s) such as: a motor vehicle repair facility, commercial printing facility, dry cleaner, photographic laboratory, landfill or as a waste treatment, storage, disposal, and processing or recycling facility?			
Is the site now, or to the best of your knowledge, ever been used as a storage location for chemicals in drums (55 gal/208 L) or other bulk containers?			
Are there now, or to the best of your knowledge, ever been damaged or discarded industrial or automotive batteries, pesticides, paints or other chemicals in individual containers of 5 gal (19 L) or greater in volume or 50 gal (190 L) in aggregate, stored on or used at the site?			
Are there now, or to the best of your knowledge, ever been pits, ponds, or lagoons on the site that may have been associated with waste treatment or waste disposal?			
Is there now, or to the best of your knowledge, ever been a chemical release on the site?			
Are there now, or to the best of your knowledge, ever been aboveground or underground storage tanks at the site?			
Are there now, or to the best of your knowledge, ever been water wells on the site? If wells are present, have contaminants been identified in the well or has the well ever been designated as contaminated by any government environmental/health agency?			
Are there now, or to the best of your knowledge, ever been any violations of environmental regulations associated with activities on the site?			
Are you aware of any previous environmental assessments that have occurred on the site?			
Is wastewater discharged on the site or from the site (other than by the sanitary sewer system) onto an adjacent site?			
Is the site served or has it been served in the past by septic tank(s) or septic systems or drainfields, or both?			
To the best of your knowledge, have any waste materials been dumped above grade, buried, and/or burned on the site?			

X3. RECOMMENDED SITE ASSESSMENT REPORT FORMAT

X3.1 *Executive Summary:*

- X3.1.1 Prepared in issue/point paper format.
- X3.1.2 Includes prioritized list of health/mission issues from site assessment
- X3.1.3 Contains a preferred and secondary remedial alternative for each issue.

X3.2 *Introduction:*

- X3.2.1 Scope of mission.
- X3.2.2 Purpose.
- X3.2.3 Methodology, that is, used applicable ASTM and DoD standards and guides.

- X3.2.4 Limitations of assessment, for example, time on site, weather conditions, pending laboratory results, and so forth.
- X3.2.5 Assumptions used.

X3.3 *Site Description:*

- X3.3.1 Location.
- X3.3.2 Site and vicinity characteristics including the physical setting.
- X3.3.3 Description of structures, roads, drinking water source, waste disposal, other improvements.
- X3.3.4 Current and past uses of property.
- X3.3.5 Current and past uses of adjoining properties.

X3.4 *Information Sources:*

X3.4.1 What predeployment information sources were consulted?

X3.4.2 What sources were consulted during site reconnaissance (who was interviewed, what records were reviewed, and so forth)?

X3.5 *Information from Site Reconnaissance:*

X3.5.1 Hazardous/unidentified substances present (storage, handling, and disposal).

X3.5.2 Potential radioactive sources present.

X3.5.3 Storage tanks (contents, storage volume, past releases, and potential for release).

X3.5.4 Evidence of other hazardous material use/release.

X3.5.5 Indications of solid waste disposal.

X3.5.6 Migration of hazardous materials release on or off site.

X3.5.7 Presence of friable asbestos.

X3.5.8 Industrial operations in surrounding environs with potential site impacts.

X3.5.9 Site map and photographs.

X3.5.10 Presence of animals.

X3.5.11 Agricultural fields in surrounding area.

X3.5.12 Other environmental pollutants.

X3.6 *Environmental Sampling Data (if done):*

X3.6.1 Sampling and analysis plan.

X3.6.2 Sample results tables.

X3.7 *Findings:*

X3.7.1 Detail environmental conditions of health/mission significance.

X3.8 *Conclusions:*

X3.8.1 Explain completed exposure pathways

X3.8.2 Explain basis for hazard assessment, that is, USA-CHPPM TG 230.

X3.9 *Discussion (Optional):*

X3.9.1 Describe potential impacts of conclusions.

X3.10 *Recommended Course of Action:*

X3.10.1 Detail risk reduction options.

X3.11 *Assumptions:*

X3.11.1 List and describe any assumptions with supporting rationale.

X3.12 *Deviations:*

X3.12.1 List any deviations from the practice.

X3.13 *Appendices:*

X3.13.1 Attach references, information source documentation, sampling documentation, and so forth.

X4. OTHER POTENTIALLY USEFUL SOURCES OF INFORMATION

X4.1 DoD References:

Allied Command Europe (ACE) Directive Number 80-64, *ACE Policy for Defensive Measures Against Toxic Industrial Chemical Hazards During Military Operations*, 20 Dec. 1996

USACHPPM Directorate of Laboratory Services, *Chain of Custody Standard Operating Procedures*, (SOP #5), February 2000

Technical Bulletin, Medical (TB MED) 577, *Sanitary Control and Surveillance of Field Water Supplies*, 1986 or current version

X4.2 ASTM Standards:³

D 5730 Guide to Site Characterization for Environmental Purposes with Emphasis on Soil, Rock, the Vadose Zone, and Ground Water

D 6044 Guide for Representative Sampling and Management of Waste and Contaminated Media

D 6232 Guide for Selection of Sampling Equipment for Waste and Contaminated Media Data Collection Activities

D 6311 Guide for Generation of Environmental Data Related to Waste Management Activities: Selection and Optimization of Sampling Design

E 1599 Guide for Corrective Action for Petroleum Releases

E 1728 Practice for Field Collection of Settled Dust Samples Using Wipe Sampling Methods for Lead Determination by Atomic Spectrometry Techniques

E 1739 Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites

E 1903 Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process

E 1912 Guide for Accelerated Site Characterization for Confirmed or Suspected Petroleum Releases

X4.3 EPA Documents:

USEPA SW 846, Recommended Analytical Procedures, Test Methods for Evaluating Solid Waste—Physical/Chemical Methods

USEPA, Draft Field Methods Compendium, OER 9285.2-11

USEPA, Subsurface Characterization and Monitoring Techniques: A Desk Reference Guide—Vols I and II, EPA 625/R-93/003a and b5

USEPA, Description and Sampling of Contaminated Soils: A Field Pocket Guide, EPA 25/12-91/002

USEPA, Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, November 2001, USEPA Region 4

USEPA, Guidance for the Data Quality Objectives Process (G-4), EPA/600/R-96/005, August 2000

USEPA, Guidance on Environmental Data Verification and Validation (G-8), EPA/240/R-02/004, November 2002

USEPA, Guidance on Geospatial Data Quality Assurance Plans (QA/G-5G), Peer Review Draft, October 2002

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

X5. BIOLOGICAL HAZARD CHECKLIST

X5.1 See Fig. X5.1.

ASSESSMENT CRITERIA		YES	NO	UNKNOWN
Pest/Vector Assessment				
Are conditions favorable for breeding vectors/pests?				
Are habitat(s) of disease vectors and carriers such as mosquitoes, rodents, sand flies, ticks present?	Circle vector(s)			
Are potential vectors/pests such as filth flies, rodents, stray dogs or cats, snakes, scorpions present?	Circle vector(s)			
Are seasonality/weather conditions favorable for breeding pests?				
Are there locations where wastes have been disposed of incorrectly and which may attract pests?				
Is the deployment site drainage adequate?				
Are personnel being bitten? What are they doing about it?				
Have personnel seen other pests (e.g., rodents, spiders, snakes)?				
Field Sanitation Assessment				
Are living/work facilities pestproof?				
Is human waste disposed of in an environmentally sound manner and in a manner that protects human health?				
Are laundry services provided or planned?				
Are any nearby receiving bodies of water to be used for wastewater disposal?				
Are hazardous materials to be stored in a manner that is environmentally sound and that will protect human health?				
Is solid waste (including regulated medical waste) disposed of in an environmentally sound manner and in a manner that protects human health?				
Are adequate food storage facilities provided?				
Is liquid kitchen waste disposed of in an environmentally sound manner that protects human health?				
Insect Countermeasures Assessment				
Is arthropod repellent on hand and being used?				
Are uniforms properly worn (e.g., pants tucked in; sleeves down)?				
Are uniforms treated with Permethrin?				
Is Permethrin on hand?				
Are bed nets on hand and being used?				
Are individuals practicing good personal/unit area sanitation?				

FIG. X5.1 Biological Hazard Checklist

ASSESSMENT CRITERIA	YES	NO	UNKNOWN
Is education on avoidance of pests and pest habitats provided?			
Is personal information distributed to soldiers (tick & rodent cards, staying healthy guides)?			
Is a Vector Surveillance program in place?			
Have action thresholds been established based upon the medical threat been developed to guide initiation of pest control operations?			
Is there a control program for disease vectors?			
Are integrated pest management procedures used?			
Does the IPM include reduction of food sources and breeding habitats?			
Are pesticides being used?			
If yes, list pesticides:			
Are pesticides properly stored?			
Are pesticide labels and Material Safety Data Sheets on hand?			

Source: *Guide to Entomological Surveillance During Contingency Operations*, October 2001

FIG. X5.1 Biological Hazard Checklist (continued)

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).