

## Chapter 1 Introduction

### 1-1. Purpose

This Engineer Manual (EM) provides geotechnical and chemical guidelines for U.S. Army Corps of Engineers (USACE) elements in the planning, installing, and reporting of soil and/or bedrock borings, monitoring wells, and other geotechnical and geochemical devices at hazardous, toxic, and radioactive waste (HTRW) sites. These guidelines are a compilation of those procedures necessary for the acquisition of environmentally representative geotechnical data and samples, using conservative methods documented in a comprehensive manner.

### 1-2. Applicability

*a.* This EM applies to all USACE commands, elements and their contractors (including architect-engineers, [AE's]) having military and/or civil works hazardous, toxic and radioactive waste (HTRW) site responsibilities and/or engaged in programs within the Comprehensive Environmental Resource, Compensation, and Liability Act (CERCLA); the Resource Conservation and Recovery Act (RCRA); the Superfund Amendments and Reauthorization Act (SARA); the Defense Environmental Restoration Program (DERP); non-mission HTRW work for other (non-Corps) offices; work within host nation agreements; or any other Corps-managed HTRW activities.

*b.* Only HTRW work involving *chemical* issues are covered within this manual. Biological waste components of HTRW are not addressed. Supplemental instructions will be provided as appropriate procedures are identified. In the interim, any requests for assistance in those areas should be directed to the Hazardous, Toxic, and Radioactive Waste (HTRW) Center of Expertise (CX) within the U.S. Army Engineer District, Omaha (CENWO), Attention: HTRW - Center of Expertise, Geoenvironmental & Process Engineering Branch (CENWO-HX-G); or Headquarters, U.S. Army Corps of Engineers (HQUSACE), Attention: Directorate of Military Programs, Policy and Technology Branch (CEMP-RT).

*c.* The specific application of and adherence to these guidelines must be tailored to each project as a function of the contaminants of concern; local geohydrologic

setting; geotechnical judgment; available resources; applicable regulatory requirements; policy and guidance; public concerns; and project mission.

### 1-3. References

Appendix A contains a list of those publications referenced by and relevant to this manual.

### 1-4. Terminology

*a. General.* As in any relatively new field using the principles, terminology, and personnel of several other fields, there is a certain lack of communication over the language used to express data and mechanisms within this new field. The situation is further compounded by alternative methods, both traditional and innovative, to complete actual projects. The additional requirements for permits, licenses, and other federal and state regulatory procedures, and the potential for litigation, add to the HTRW site complexities.

*b. Corps situation.*

(1) Within USACE, a given HTRW project may be performed totally in-house, partially in-house, or by one or more contractors/AE's (either independently reporting to the Corps or through a system of prime- and subcontracting). One Corps office may broker the work of another who in turn contracts the effort. In some cases, one Corps district may design a project and award the contract while a second district supervises construction.

(2) Providing program level technical guidance in this administrative situation requires the guidance to be specific, while allowing any field activity to adapt the guidance to its needs. The intent is to foster the defense of variances, not the defense of recommended methods and procedures. This approach is warranted to provide the Corps with compatibility and continuity of HTRW investigations while allowing functional flexibility. With this in mind, the following three terms are introduced: the *field activity* (FA); the *field drilling organization* (FDO); and the *drilling and well installation plan*. These terms are defined in paragraphs 1-4c(2), (3), and (1), respectively. Generically, these terms refer to a client-contractor-contract relationship. This relationship can be applied to both in-house and contracted efforts, thereby providing consistency for the geotechnical portion of the Corps HTRW involvements.

*c. Definitions (alphabetically arranged).* These definitions are intended to guide the reader through the use of this manual. While other terms with equivalent definitions may be familiar to some readers, the terminology as defined here provides a common basis for the **CONSISTENT** understanding by **ALL** readers.

(1) Field Sampling Plan (FSP). The FSP is contained within the Sampling and Analysis Plan (SAP), and describes the drilling and well installation plan. The SAP and FSP requirements are outlined in EM 200-1-3. The FSP is approved by the FA or FDO before field activities begin. The plan specifies the particulars of the field effort; for example: borehole/well/sample locations, depths, equipment, materials, procedures and alternatives, quality control measures, and other topics required by the responsible FA. Implementation is by the FDO.

(2) Field activity (FA). That Corps element minimally headed by a Commander or Director; e.g., district, laboratory, or agency, assigned or otherwise acquiring the responsibility to administer a contract, agreement, or in-house Corps procedure to research, investigate, design, and/or construct a project involving hazardous and/or toxic wastes.

(3) Field drilling organization (FDO). That office within the Corps or contracted by the Corps responsible for execution of the drilling plan. In a contracted arrangement, the prime contractor is regarded as the FDO. Sub-contractors, even though they may physically perform the field work, are the responsibility of the prime contractor, whom the Corps holds contractually accountable.

(4) Geotechnical data quality management (GDQM). The development and application of those policies and procedures required to obtain and utilize accurate and representative geotechnical information throughout the entire HTRW project cycle, from predesign investigations to postconstruction monitoring.

(5) Hazardous, toxic, and radioactive waste (HTRW). A USACE idiom referring to substances which because of their properties, occurrence, or concentration, may potentially pose a threat to human health and welfare, or to the environment. This includes materials defined by federal regulations as hazardous waste, hazardous substances, and pollutants.

(6) Monitoring well. A monitoring well is a device designed and constructed for the acquisition of groundwater samples that are representative of the chemical quality of the aquifer adjacent to the screened interval, unbiased by the

well materials and installation process; and which, if so designed, provides access to measure potentiometric head across the screened interval.

(7) Redevelopment/well rehabilitation. A procedure which restores the original or near original pumping capacity to an existing well by the removal of sediment, precipitation, flocculent, surface run-in, or other built-up materials from within that well.

(8) Screened interval. That portion of a well which is directly open to the host environment/aquifer by way of openings in the well screen.

(9) Site safety and health plan (SSHP). A project-unique document approved by the responsible FA for FDO compliance. The plan includes the identification of hazardous substances present, recommended action upon encountering those substances, project/site safety requirements, organizational safety responsibilities, and the identification of supporting health and safety activities.

(10) Well development. A procedure which locally improves or restores the aquifer's hydraulic conductivity, well capacity, and removes well drilling fluids, muds, cuttings, mobile particulates, and entrapped gases from within and adjacent to a newly installed well.

*d. Acronyms.* Appendix B contains a list of the abbreviations used in this manual.

## 1-5. Background

*a. EM 1110-1-4000.* As a GDQM mechanism, this manual provides guidance for collection and documentation of geotechnical information. Site-specific deviations should be described and supported in the drilling and well installation plan.

(1) Technical understanding and evaluation of HTRW studies involve an appreciation of the interactions among many fields including geology, hydrology, geotechnical engineering, and chemistry. This scenario is complicated by the trace (low parts per billion) levels of regulated chemical species that are detectable in the environment and which, when detected or suspected, trigger intricate and costly response actions. Slight deviations from prescribed drilling, well installation, sampling, or analytical procedures may bias or invalidate the reported concentrations. This sensitivity requires that procedures be relevant, standardized, documented, understood, and followed. Despite these procedures, the normal heterogeneity and anisotropy of natural field occurrences are, in themselves, frequently sufficient to confuse the appropriate interpretation of the

gathered field data.

(2) The specific content of this manual will be periodically updated based upon reader suggestions, lessons learned, technological advances, and Corps needs. Issues of significant concern will be disseminated Corpswide in a more expeditious manner.

(3) Not all geotechnical personnel will agree on every practice advocated herein. Any such variations should be over a matter of degree, not substance. If the reader perceives a technical difficulty in any of this manual's contents, the reader is requested to contact the proponent.

*b. Proponency.* The technical proponents for this manual are the Policy and Technology Branch, Environmental Division, Directorate of Military Programs (CEMP-R), and the Geotechnical and Materials Branch, Engineering Division, Directorate of Civil Works (CECW-EG), Headquarters, U.S. Army Corps of Engineers. All comments and suggestions should be directed to HQUSACE, CEMP-R, 20 Massachusetts Avenue, N.W., Washington, D.C. 20314-1000.