Chapter I

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Background

As of September 30, 2003, more than 439,000 releases from leaking underground storage tanks (LUSTs) have been reported nationwide. Cleanups have been initiated at more than 403,000 of these sites, and more than 303,000 sites have been cleaned up. The backlog of sites still to be cleaned up is more than 136,000. In many cases, the workload for state regulators (who must oversee 50 to 400 cleanups at a time) is burdensome.

To compound the problem, cleanups are expensive. The costs of remediating sites with soil contamination vary between $10,000 and $125,000. Costs for remediating sites with groundwater contamination can range from $100,000 to over $1 million depending on the extent of contamination.

A primary factor in the high cost cleanups is the use of cleanup methods that are either inappropriately selected or not optimally designed and operated given the specific conditions of the site. Pump-and-treat, the most commonly used method for remediating groundwater, is often unsuccessful because either the source of contamination is not adequately addressed, or the systems are not optimized. Even when properly operated, pump-and-treat systems have inherent limitations[1]: they may not work well in complex geologic settings or heterogeneous aquifers; they often stop reducing contamination long before reaching intended cleanup levels; and in some situations they can make sites more difficult to remediate by smearing contamination across the subsurface. Landfilling, the most frequently used method for addressing contaminated soils, does not remediate soils; this method simply movess the problem from one location to another. In addition to being costly, transporting contaminated soil off-site increases the risk of harming human health and the environment.

With so many sites requiring remediation at such an enormous cost, the Environmental Protection Agency (EPA) actively promotes faster, more effective, and less costly alternatives to traditional cleanup methods. EPA's Office of Underground Storage Tanks (OUST) continues to work with

[1]In spite of its limitations, there may be some situations where pump-and-treat is the most appropriate remediation alternative available (*e.g.*, to remediate a small, dissolved phase plume or to contain the plume in order to prevent migration into uncontaminated areas).

state and local governments to encourage the use of the most appropriate cleanup technology for each and every site. When this manual was first published in 1994, it covered the first eight technologies listed in the table of contents (Chapters II through IX). The manual was updated in 1995 to add two additional technologies (Chapters X and XI). Back then, these ten technologies were referred to as "alternative technologies" because although they had the ability to make cleanups faster, more effective, and less costly than traditional options, they were not widely used (although they certainly are today). The current update (May 2004) adds two new technologies (chemical oxidation-Chapter XI, and enhanced aerobic bioremediation-Chapter XII) to the suite of "alternative technologies".

Purpose Of This Manual

The purpose of this manual is to provide you—state and local regulators—with guidance that will help you review corrective action plans (CAPs) that propose alternative cleanup technologies. The manual does not advocate the use of one technology over another; rather it focuses on appropriate technology use, taking into consideration sitespecific conditions and the nature and extent of contamination. While the manual focuses on the remediation of leaking underground storage tank sites, some of its basic concepts can be applied at hazardous substance and hazardous waste sites as well. .

The manual is designed to enable you to answer two basic questions when reviewing a CAP:

- Has an appropriate cleanup technology been proposed?
- Does the CAP provide a technically sound approach to the cleanup?

Scope And Limitations

This manual is intended to provide technical guidance to state regulators who oversee cleanups and evaluate CAPs. The document does not represent the issuance of formal policy or in any way affect the interpretation of the regulations.

The text focuses on engineering-related considerations for evaluating each technology. It does not provide instruction on the design and construction of remedial systems and should not be used for designing

CAPs. Nor should it be used to provide guidance on regulatory issues such as securing permits and establishing cleanup standards, health and safety issues, state-specific requirements, or cleanup costs.

This document is not intended to be used as the sole reference for CAP review. Rather, it is intended to be used along with published references, guidance from others more experienced with alternative technologies, information from training courses, and current journals. The material presented is based on available technical data and information and the knowledge and experience of the authors and the peer reviewers.

How To Use This Manual

We encourage you to use this manual at your desk as you review CAPs. We have designed the manual so that you can tailor it to meet your state's or your own needs. The three-ring binder allows you to insert additional material and remove certain tools (*e.g.*, flow charts, checklists) for photocopying. Also, you can add your own notes in the margins provided.

The manual contains discussions of eight different alternative cleanup technologies. Tabs signal the beginning of each chapter (including the Introduction and Abbreviations And Definitions) so you can flip quickly to the appropriate section. We have included a table of contents in each chapter to help you locate the information you need.

Each technology chapter contains the following tools which can help expedite and/or improve the review process:

- An evaluation process flow chart, generally the third exhibit in each chapter, can help you understand the overall review process for each technology. This flow chart serves as a "road map" for the chapter and for the decisions you will make during the evaluation process.

- A checklist(s), located at the end of each chapter, can help you determine whether or not the CAP contains all of the necessary information. The checklist lists the most important factors to evaluate for the successful implementation of each technology.

- A list of current references, located near the end of each chapter, provides sources of additional information.

- Advantages and disadvantages of each technology, initial screening criteria, and other data specific to each technology.

How to Obtain Additional Copies of the Manual

A limited number of single copies are available directly from OUST. Contact OUST by telephone at 703-603-9900 and ask for "publications outreach". The entire document is also available in electronic format (PDF) from the "Publications" section of OUST's web site at *http://www.epa.gov/oust/pubs/tums.htm*.