

Following the development of the fundamental science and principles underlying incineration, the authors turn to the description of systems in the third major section of this book. The topics range from descriptions of incineration systems to air pollution control for incinerator emissions. Under a major section titled “Equipment,” the following chapters were found:

- Hazardous Waste Combustors
- Waste Heat Boilers
- Quenchers
- Air Pollution Control Equipment
- Materials Handling and Ancillary Equipment

The final major segment of the book was designed to expose the reader to some aspects of the design for an overall waste incineration plan. The authors review the three chapters of this section:

The mechanics of the design process—the collecting of required information, preparation of schematics, application of material and energy balances plus other calculations, writing of a design report, and so on, are presented in Chapter 12. Economic analysis, an obviously important facet of any design procedure, is discussed in Chapter 13. Since illustrative examples often paint a clearer picture for the reader than textual presentation, the final chapter of this text, Chapter 14, consists mainly of two rather extensive plant design problems and their solutions. Since both problems involve overall facility design, these examples serve the function of merging many of the equipment design procedures presented earlier in the text into a more complete plant design package.

Included with the book is a floppy disk that contains an “HWI Software Package”. That disk contains three programs and two data files. The programs include (1) performing hazardous incineration calculations, (2) a tutorial and (3) an expanded version of the first section to allow for waste blending.

Reviewing this book was an enjoyable experience, perhaps because I was a consultant for a firm that had incinerators or perhaps because it is a text written by chemical engineering professors for chemical engineers (and chemical engineering students). The real reason reviewing the book was so enjoyable was because it is well-written and thoroughly covers the topic. It is replete with worked example problems and problems for student assignment. In conclusion, it is my judgment that this is a sterling book for both students and practitioners.

Gary F. Bennett

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### **Principles and practices of bioslurping**

Matthew C. Place, Christopher T. Coonfare, Abraham S.C. Chen, Ronald E. Hoeppe, Stephen H. Rosansky (Eds.), Battelle Press, Columbus, OH, 2001, 190 pp., US\$ 65.00, ISBN 1-57477-107-8

The foreword to this book so well describes the problem posed by petroleum fuel contamination and the unique approach to it that I reproduce it here as the center point of my review.

“Leaks and spills from pipelines and underground and aboveground storage tanks at fueling terminals and service stations may result in extensive contamination to the aquifers and vadose (or unsaturated) zones beneath them. Leaked and spilled petroleum hydrocarbons (such as jet fuels, gasoline, diesel, heating oils, and crude oils) may pose direct and indirect safety hazards and cause adverse effects to human health and the environment. Therefore, it is desirable to remove free-phase and dissolved plumes and remediate contaminated vadose zones, especially in cases where contaminant plumes are situated underneath densely populated areas.

Over the past 10 years, bioslurping has evolved from a primarily experimental technology to a preferred method for remediating sites contaminated with free-phase product. By combining vacuum-assisted free-product recovery with bioventing and soil vapor extraction, bioslurper systems simultaneously recover free-product and remediate the vadose, capillary, and saturated zones. Specifically, bioslurper systems use an aboveground vacuum pump to create enough vacuum and airlift to withdraw light, nonaqueous-phase liquids (LNAPLs) from the subsurface, along with soil gas and relatively small amounts of groundwater. The accompanying pressure gradient promotes the migration of the free-product to the well via more permeable flow pathways, and avoids the trapping of free-product below the water table by preventing rebound of the water table. Thus, bioslurping offers improvement on more traditional free-product recovery technologies, which tend to rely on hydraulic gradients and cones of depression to promote free-product movement.

This manual provides the reader with a detailed description of bioslurping theory, practice, and system design. It begins with a description of the principles of free-product migration through the subsurface and methods for enhancing the recovery of free-product. Chapter 2 describes methods for characterizing the site and evaluating free-product recovery potential at the site. In addition, methods for determining the potential for groundwater contamination from free-product sources are presented, and a protocol for free-product recovery testing is provided so readers of this book can determine if bioslurping is an appropriate free-product recovery technology for use at their sites. Chapter 3 describes the design, installation, and monitoring of pilot-scale systems; the chapter also presents methods for determining LNAPL recovery potential, vadose zone and LNAPL radii of influence, and the bioventing potential of the bioslurper at the site. Chapter 4 provides recommendations for full-scale design of a bioslurper system using the data generated from a pilot test area, and includes a description of the operation and maintenance of full-scale bioslurper systems (including treatment of aqueous and vapor discharge streams) Finally, chapter 5 presents an exit strategy for LNAPL recovery and site closure. This example exit strategy has been designed to accommodate the various site-specific conditions that readers of this book are likely to encounter at their sites; also, the strategy can be modified in order to meet site- and/or project-specific regulatory goals.”

Actually, the last chapter goes well beyond what is described in the foreword. Entitled “Bioslurper System Operation and Maintenance,” the authors begin with troubleshooting but follow with discussions of the operation of oil/water separators, dissolved air flotation systems, granular activated carbon/clay anthracite adsorption media, gravity settling tanks, reinjection and stack-gas treatment systems including removal (or destruction) of hydrocarbons by adsorption on granular activated carbon, catalytic thermal oxidation or internal combustion engines.

The book ends with three comprehensive appendices:

- Bioslurping implementation cost-estimating Guide.
- Water treatment technologies.
- Stack-gas treatment technologies.

Bioslurping is an innovative cleanup technology for remediation of sites contaminated with light, nonaqueous phase liquids. Its application is extremely well-described in this book—clear, concise, well-written and comprehensive.

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