The authors conclude the book with three appendices:

1. Kansas State University Methods for Standard Analysis of Total Recoverable Petroleum Hydrocarbons in Soils Using Infrared Spectrophotometry.
2. Full-Scale Design Drawings and Calculations.
3. Project Cost Spreadsheets.

As with all other books in the series, the subject is well-researched, well-reported and well-documented (especially reporting cost data).

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Modular Remediation Testing System

Thomas Reeves, Jonathan Miller, Paul C. Johnson (authors); Katherine Balshaw-Biddle, Carroll L. Oubre, C. Herb Ward (Eds.), Lewis Publishers, Boca Raton, FL, 2000, US$ 64.95, 276 pp., ISBN: 1-56670-468-5

This monograph is one of 10 reports resulting from studies conducted for a project at Rice University, Houston, Texas, under a US Department of Defense (DOD) grant [Advanced Applied Technology Demonstration Facility program (AATDF)]. The goal of the AATDF was to enhance the development of innovative remediation technologies for DOD by facilitating the process from academic research to full-scale utilization.

Most of these reports deal with contaminated site remediation technology, i.e. phytoremediation, reactive barriers, soil vapor extraction, etc. This one uniquely discusses the experience gained in design, construction, transportation, operation, and disassembly of a modular test facility.

Entitled an "Experimental Controlled Release System (ECRS)", this unit was designed to be a modular, portable and durable research tool for testing remediation technologies in a contained, yet realistic setting. The system was built at a pilot-size scale, using full-size standard equipment to provide cost-effective demonstrations at a scale between laboratory bench- and full-scale field implementation. Additionally, the complete system was to be transportable and was transported on a single semi-trailer.

The ECRS was designed to address contaminants, such as ". . . fuels, solvents, petroleum oils and lubricants, heavy metals, and mixtures of these wastes. The media of interest include soil and groundwater. The technologies and processes of interest include in situ contaminant destruction or mobilization, plus enhanced site characterization/monitoring tools.

A main objective is accurate measurement of contaminant removal efficiency through calculation of mass and energy balances. To this end, the ECRS design will be a closed system and researchers will have access to portable analytical equipment, such as a gas chromatograph and a data logger. This instrumentation will be housed in a portable climate-controlled building where researchers will also be able to use or store their own instrumentation for sampling and analysis."

The results of their work are described under the heading "General Attributes of ECRS". The ECRS is a unique, modular testing environment. The major attributes of this

system that distinguish it from past test facilities were demonstrated to be the following:

- Portable
  - Containerized testing unit shipped to the researchers location and setup at modest cost.
  - Can be shipped to a remediation site for treatability tests.
- Tightly sealed
  - System tightly sealed to facilitate mass balance determination.
- Pilot-scale facility
  - Intermediate-size test (pilot-scale) between bench-scale and full field-scale.
  - Tank size suited for projects of 1–1.5 years duration.
- Flexible design
  - Includes SVE, air injection, and ground-water systems.
  - Soil tank size facilitates a range of packing conditions to simulate subsurface environments.
  - Can simulate vadose or aquifer conditions.
  - Can be packed with contaminated soil or can release contaminants or chemical amendments into clean soil.
- Easy to construct
  - Available design drawings for construction of future units.
  - Standard engineering equipment for easy fabrication and maintenance.
- Easy to operate and maintain
  - Standard engineering equipment and components for easy maintenance.
  - Designed for easy access to controls, gauges, and filters.
  - Manual outlines operations and maintenance.
- Affordable
  - No overhead costs, only budget for shipping and maintenance costs.
  - No permanent ECRS staff.
  - No travel costs for researcher, staff, and their instrumentation.
  - Minimal staff needed to operate programmable equipment.
  - Reduced regulatory requirements, only spill containment and appropriate waste treatment.
- Faster tests
  - Reduced or eliminated regulatory permitting
  - Ready to operate within one week of delivery
  - Can be programmed to operate 24 h per day, 7 days per week”

Four major tests were described.

1. Air sparging and oxygen-releasing material.
2. Degradation of munitions compounds.
3. Air sparging.
4. Surfactant biodegradation.

As I have noted in previous reviews of reports from the same series, the appendices contain much of the engineering details for construction of the unit. In this case, they describe the design and control systems (PID diagrams) for the unit. The appendices by

heading, are

- Appendix A: Engineering design,
- Appendix B: Health and safety plan,
- Appendix C: System (Unit 1) tests and research by equilon,
- Appendix D: System (Unit 2) package and engineering specifications,
- Appendix E: Final (Unit 2) engineering diagrams.

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