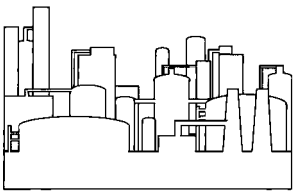

Fort Hood Investigates Beneficial Reuse of Pesticide-Contaminated Soil

Jeff Salmon and Cheryl Detloff

*The management of pesticide-contaminated soil on military installations is becoming an important issue. Fort Hood found itself having to deal with this issue, excavating 3,000 cubic yards of chlordane-contaminated soil. The question of what can be done with this soil has prompted Fort Hood to begin a multiphase investigation into the beneficial reuse of chlordane-contaminated soil. Fort Hood had been investigating many methods for the remediation and treatment of pesticide-contaminated soil, which led us to the encapsulation method. Phase 1 of this investigation involves proving that encapsulated pesticide-contaminated soil will not leach and securing Texas Commission on Environmental Quality (TCEQ) approval to use this encapsulated soil as daily cover on the Fort Hood municipal solid waste landfill. Phase 1 is the focus of this article. © 2005 Wiley Periodicals, Inc.**

During a field investigation in 2003, approximately 3,000 cubic yards of chlordane-contaminated soil was excavated on Fort Hood. This soil is currently being stored in a lined, closed-loop area. When tested, these samples contained chlordane levels ranging from 15.4 ppm to 82.9 ppm. Initial investigation revealed that disposal of this soil will cost approximately $135 per ton, or over $550,000, while placing this soil in Fort Hood's special waste trench will cost approximately $29 per ton, or approximately $117,000. Searching for a more efficient option, Fort Hood investigated encapsulation of chlordane-contaminated soil for beneficial reuse in lieu of disposal or placing in a landfill. Initial study also showed that encapsulation of chlordane-contaminated soil will cost approximately $8.64 per ton, or around $35,000. Fort Hood desires to use this soil as a test for reuse methods in lieu of disposal.

The primary purpose of this project is the beneficial reuse of 3,000 cubic yards of chlordane-contaminated soil by using it as daily cover

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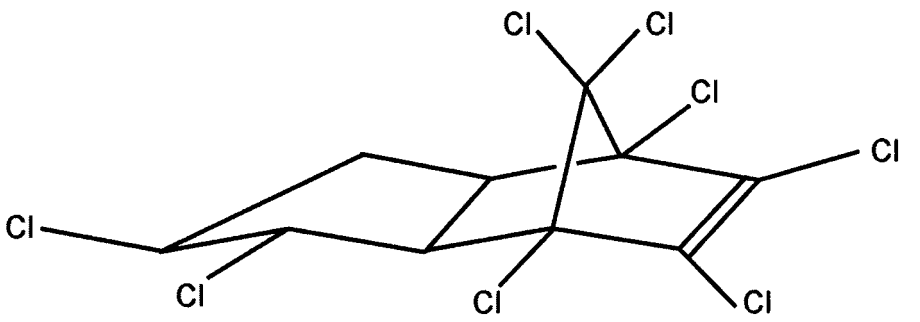
Exhibit 1. Chemical Structure of Chlordane ($C_{10}H_6C_{18}$)



on a preselected, isolated area of the Fort Hood municipal solid waste (MSW) landfill. In the execution of this project, many other objectives will be accomplished that will significantly aid Fort Hood and the U.S. Army. The execution of this project will include the investigation into encapsulation methods, the testing of leaching characteristic of encapsulated chlordane, the validation of a lined MSW cell and leachate monitoring as an acceptable location, and the final disposition of a household hazardous waste. To accomplish this, Fort Hood must first secure the Texas Commission on Environmental Quality's (TCEQ's) approval to conduct this test. The objective of the testing was to show that chlordane-contaminated soil treated with Soil Sement® polymer emulsion would not leach the pesticide.

Chlordane is a man-made pesticide approved for use by the Environmental Protection Agency (EPA) from 1948 until its ban in the United States in 1988. Before 1978, chlordane was used as a pesticide in agricultural crops, lawns, and gardens as a fumigating agent. Concerned over cancer risks and evidence of human exposure, persistence in the environment, and danger to wildlife, the EPA phased out aboveground use of chlordane. From 1983 until 1988, chlordane was approved for use to control termites in homes and was only applied underground to foundations. Today, chlordane is not used in the United States; however, because of the chemical's persistence, it remains in the environment and is a human health concern. Chemically, chlordane is a chlorinated cyclodiene with chemical formula $C_{10}H_6C_{18}$ (**Exhibit 1**). Technical chlordane is not a single chemical, but a mixture of over 140 chemicals. Major components are trans-chlordane (also know as gamma-chlordane or beta chlordane), cis-chlordane (also know as alpha-chlordane), beta-chlordane, heptachlor, and trans-nonachlor. Because technical chlordane contains so many chemicals, it is difficult to specify some chemical and physical properties. Technical chlordane is clear-to-amber-colored viscous liquid. The volatility changes over time as the more volatile components are removed. Chlordane is not soluble in water; however, it is miscible in aliphatic and aromatic hy-