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Geophysical Techniques for Sensing Buried Wastes and Waste Migration

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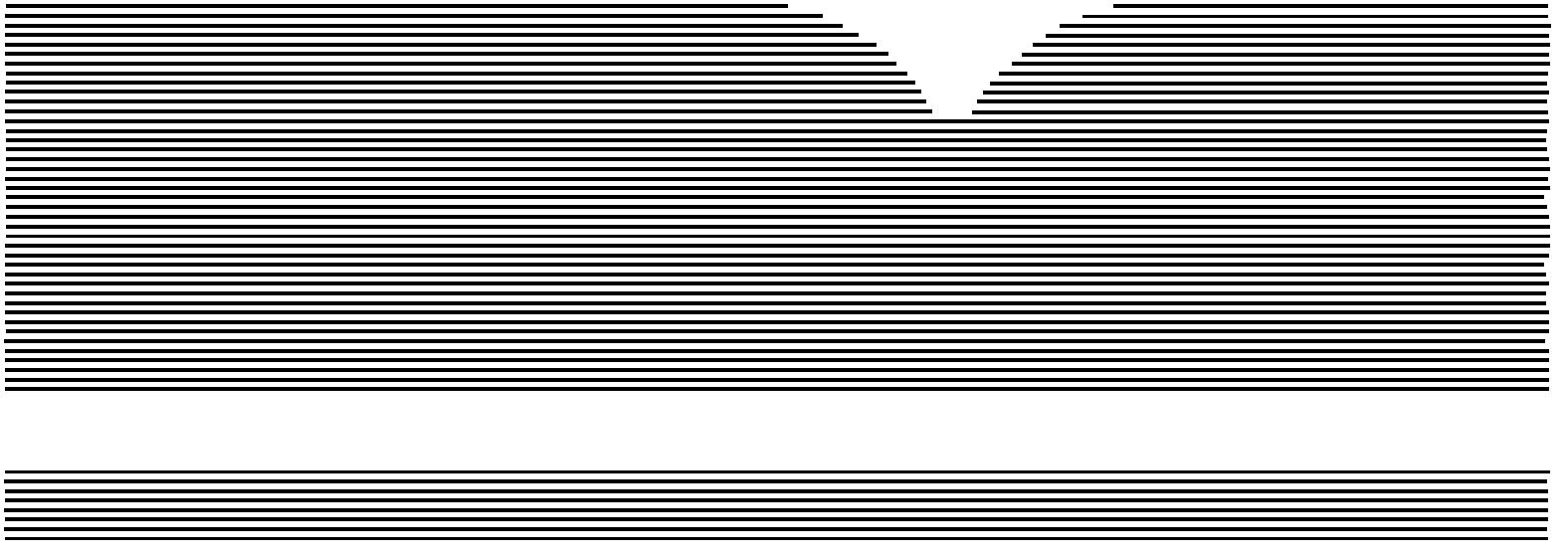

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GEOPHYSICAL TECHNIQUES FOR SENSING BURIED WASTES AND WASTE MIGRATION

by

Richard C. Benson,
Robert A. Glaccum, Michael R. Noel
TECHNOS, Inc.
3333 N.W. 21st. Street
Miami, FL 33142

Subcontractors to Lockheed Engineering
and Management Services Company, Inc.
P.O. Box 15207
Las Vegas, Nevada 89114

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Project Officer
J. Jeffrey van Ee
Advanced Monitoring Systems Division
U. S. Environmental Protection Agency
Las Vegas, Nevada 89114

ENVIRONMENTAL MONITORING SYSTEMS LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
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Descriptions of the use of six geophysical techniques are presented to provide a broad understanding of the application of these techniques for sensing buried wastes and waste migration. Technical language and jargon are avoided as much as possible so that those with limited technical background can acquire a general understanding of current techniques and sufficient background to define project requirements, select professional support, and monitor and direct field programs.

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ABSTRACT

Descriptions of the use of six geophysical techniques are presented to provide a broad understanding of their application to sensing buried wastes and waste migration. Technical language is avoided as much as possible so that those with limited technical background can acquire a general understanding of current techniques sufficient to define project requirements, select professional support, and monitor and direct field progrms.

Emphasis on cost-effective investigations at hazardous waste sites requires an integrated, phased approach: (1) preliminary site assessment involving the use of aerial photography, on-site inspections, and readily available information to approximate site boundaries and locations of waste concentrations, as well as probable site geology; (2) geophysical surveys to pinpoint buried wastes, estimate quantities, and delineate plumes of conductive contaminants in groundwater; and (3) confirmation of groundwater contamination through monitoring well networks designed on the basis of plumes and subsurface stratigraphy defined by the geophysical surveys.

The six geophysical techniques described include metal detection, magnetometry, ground penetrating radar, electromagnetics, resistivity, and seismic refraction. Metal detectors and magnetometers are useful in locating buried wastes. Ground penetrating radar can define the boundaries of buried tranches and other subsurface disturbances. Electromagnetic and resistivity methods can help define plumes of contaminants in groundwater. Resistivity and seismic techniques are useful in determining geological stratigraphy.

Simple metal detectors respond to changes in electrical conductivity caused by the presence of metallic objects, both ferrous and nonferrous. Magnetometers detect perturbations in the earth's geomagnetic field caused by buried ferromagnetic objects such as drums, tools, or scrap metal. They sense ferrous objects at greater depths than metal detectors and can locate objects even in the presence of interferences created, for instance, by fences.

A ground-penetrating radar system radiates short-duration electromagnetic pulses into the ground from an antenna near the

surface. These pulses are reflected from interfaces in the earth (such as trench boundaries) and picked up by the receiver section of the antenna. Electromagnetic conductance measuring devices yield a signal proportional to the conductivity of the earth between the transmitter and receiver coils. Many contaminants will produce an increase or decrease over the background conductivity and thus can be detected and mapped. The resistivity method measures the electrical resistivity of the geohydrologic section which includes the soil, rock, and groundwater and provides a tool to evaluate contaminant plumes and locate buried wastes. Seismic refraction techniques can determine the thickness and depth of geologic layers and the travel time or velocity of seismic waves within the layers, thus revealing variations in site conditions.

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