Background:
It is estimated that 11 million acres of land need to be assessed to identify subsurface unexploded ordnance (UXO), with costs estimated to be about $1.4M per acre. The ranges where UXO can be found are distributed throughout the country under a variety of environmental conditions. This project will study how these environmental conditions will impact the transport of chemical signature molecules from subsurface UXO to the ground surface.

Objective:
Currently, there are many government programs that are developing chemical detector platforms that can provide a separate unique signal to classify subsurface objects identified with existing geophysical systems. The objective of this project is to develop a validated subsurface transport model that can be used to predict the spatial and phase-specific concentration of chemical signature molecules derived from shallow UXO under the influence of specific environmental conditions.

Summary of Process/Technology:
The first task is to modify a soil chemical transport model to evaluate the impact of the environmental processes. Task two involves the measurement of specific transport parameters currently not available in the literature for explosive signature molecules. Task three will be a laboratory validation study that will confirm the most critical parameters included in the simulation model. Task four will utilize this validated model to assess the impacts of environmental conditions on the transport of chemical signature molecules from shallow UXO. Task 5 involves the characterization of ordnance chemical release rates and a field site evaluation of soil residues adjacent to actual UXO.

Benefit:
This project will provide the Department of Defense (DoD) with a new tool to assess the functionality of chemical detector platforms already in service to classify shallow UXO from non-UXO. Use of the model, simulations, and systems analysis will improve the decisions made on the utility of chemical detector platforms in a variety of environmental conditions that are expected to have an important role in the transport of chemical signature molecules from shallow UXO.

Accomplishments:
During FY 1999, various analytical laboratory experiments were conducted. This work focused on measuring water solubility versus temperature for 2,4-DNT and determining vapor-solid partitioning as a function of the soil moisture content. Soil column flux tests, using mortar and artillery shells, were conducted, and test results have indicated that the initial chemical signature is released from the chemical residue found in the paint. Additionally, soil samples collected from areas adjacent to UXO and then tested for explosive chemical residues did not contain sufficient trace levels to demonstrate a distinct classification signal. Also during FY 1999, a subsurface transport simulation model, known as T2TNT, became fully operational after the inclusion of partitioning and transport process improvements. The model has shown excellent correlation with data generated from the soil column flux test. The project will continue to validate the model for future use.

Contact Information:
Mr. James Phelan
Sandia National Laboratory
P.O. Box 5800, MS 0719
Albuquerque, NM 87185-0719
Phone: (505) 845-9892
Fax: (505) 844-0543
E-mail: jmphela@sandia.gov