# Innovative Directional and Position Specific Sampling Technique

**Developer: UTD, Inc.**
**Contract Number: DE-AC21-92MC29119**
**Crosscutting Area: CMST**

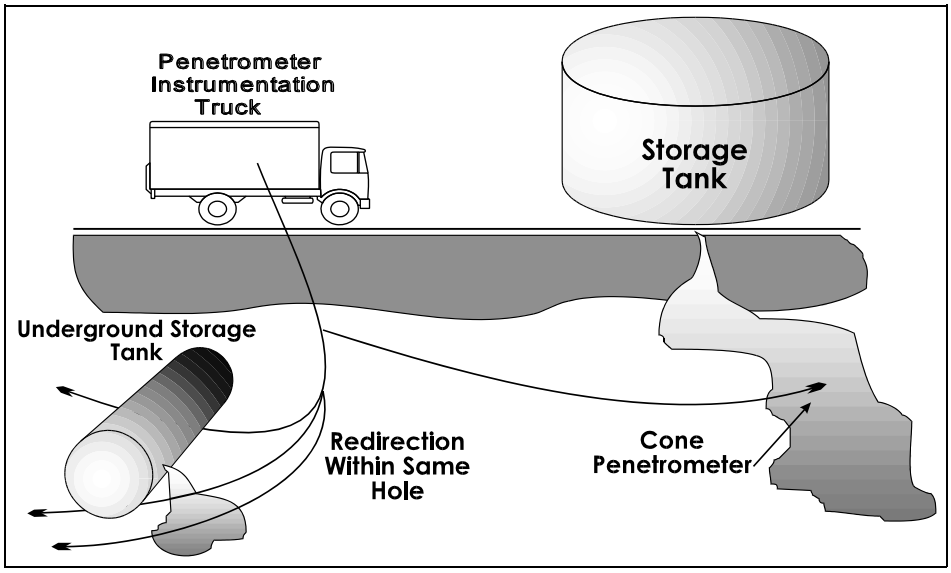
Subsurface Contaminants FOCUS AREA

**Problem:**

Current sampling strategies to characterize soil and groundwater contamination are often limited by the cost of installing monitoring wells. The alignment of the well or the device inserted into the soil is conducted on an aim-and-shoot basis with only broad approximations of the actual locations of sampling points. True directional control or even accurate knowledge of the location of the point being sampled is not known, when in fact small errors in approximations of sampling location can have a significant impact on the interpretation of plume origins and other characteristics.

**Solution:**

A unique real-time, in situ POsition LOcation (POLO) determination device which is smaller than other devices and not influenced by magnetic material was developed. The Polo system offers, for the first time, the ability to map the position of characterization sensors in a borehole simultaneously with their insertion. Additionally, development of the position location tool opens the door to future developments which will allow for directionally controlled insertion of instruments.




**Benefits:**

- Immune to magnetic materials that are located beneath landfills, and building foundations
- More timely, more cost effective and safer site characterization
- Potential for future delivery of ampling devices

**Technology:**

The basic concept of the POLO system is to define the trajectory of a borehole by navigating from point to point along its length to describe the shape and orientation of the centerline between each set of points.

Measurement is made by inserting an instrumented pipe section whose centerline corresponds to the centerline of the borehole. Strain gauge measurements on the walls of the test section provide trajectory information. The measurement module advances as the penetrometer rod is pushed into the borehole; it thus traverses the length of the borehole making measurements of the hole axis at successive measurement points. As

a key Department of Energy (DOE) need is the characterization of sites through underground direct sampling, or through the monitoring of underground conditions. The POLO system is believed to be the only downhole position location tool which will meet the operational constraints of penetrometers and lysimeters as they are currently used and provide accurate downhole three-dimensional position determination. Further, the POLO system, used in conjunction with a steerable head, offers the oportunity to significantly extend the application of existing sampling techniques from their current mode of operation in vertical approximate location penetrations to both angled insertion and directional control of insertion to specific locations.

The POLO system has the potential to provide a reduction in public and occupational health risk as well as environmental risk by providing greater capability in characterization and monitoring through directional placement of sampling devices adjacent to steel or other magnetic material. Time of remediation will also be improved due to reduction in characterization time and monitoring device installation time, both of which affect remediation time.

**Project Conclusion:**

The subject contract ended in September 1994. Development of the POLO System concluded in with production and demonstration of a full-scale, integrated system. A preliminary field trial was conducted at the Fort Belvoir Army Base in Northern Virginia during June 1994. This was a prelude to performing a Full-scale Integrated System Demonstration at the Savannah River Site (SRS) in July 1994.

Under the contract, one prototype POLO system (POLO rod, data acquisition system, and initializer) plus a spare POLO downhole rod were manufactured. Based on lessons learned in this initial effort, a new UTD contract (DE-AR21-94MC31178) was awarded by FETC to include the integration of a commercial POLO system with the SCAPS truck.

The POLO system (the strain gaged rod and the tracking algorithm, which are the heart of the system) has been patented.There is a commercial POLO system at SRS (POLO rod, downhole electronics, initializer, and computer). The property was officially transferred earlier this year.

UTD is actively marketing the product and is reported to be making progress. Currently, UTD is manufacturing a POLO-based tracking system for use inside of drill strings. This activity is being funded by a commercial drilling company. In addition, UTD has been marketing the POLO system to penetrometer contractors, selling the system as a bend indicator warning system, in addition to a path tracking device. The fruits of these efforts are expected in the next one to two years.

UTD expects to manufacture, sell, and service POLO units. UTD has the capability to produce a POLO system in six to eight weeks, after receipt of an order.

**Contacts:**

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DOE's Federal Energy Technology Center supports the Environmental Management - Office of Science and Technology by contracting the research and development of new technologies for waste site characterization and cleanup. For information regarding this project, the DOE contact is:

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