A TECHNICAL OVERVIEW OF OUR SAMPLING EQUIPMENT

Geoprobe ®

A TECHNICAL OVERVIEW OF OUR EQUIPMENT

The information in this fact sheet is provided as a service to those of our customers, who are already familiar with the Geoprobe® equipment and who have expertise in environmental surveys using this sampling concept. The following gives you a detailed overview of the information our team can give you.

NIRAS has three mobile drilling rigs with accompanying mobile laboratory equipment for on-site analysis. We are one of few operators in Europe who are able to take samples at depths as deep as 50 metres. We have almost 20 years of experience in using this equipment in various geological contexts. The five core members of our field team have been with us all the years without any replacements. We have completed close to a thousand individual customer assignments.

MIP/MIHPT probing
Surveys involving MIP/MIHPT probing produce quick and accurate information about geology and extent of contamination. MIP probes are extremely suitable for characterising and delimiting source areas containing e.g. chlorinated solvents. When the MIP probe is driven into the soil, the soil is heated to 120 degrees causing any contaminants to diffuse through the probe membrane and to the surface by a carrier gas. The carrier gas is then analysed using a gas chromatograph with FID, PID and XSD detectors. The MIP system generates online results that can be used directly to select the next sampling position and allows real-time adjustment of the surveying strategy.

The MIHPT probe combines an MIP and an HPT probe and provides information about contamination and geology in the same log. This ensures information about which geological units the primary contamination mass is located, which is crucial knowledge when trying to understand migration pathways and assess contaminant flux.

Low Level MIP/MIHPT probing
As one of the first in the world, NIRAS has bought and implemented an LL-MIP system. This allows NIRAS to offer MIP/MIHPT as Low Level MIP with 10-50 times higher sensitivity compared with normal MIP. Whereas the MIP probe is intended to characterise source areas, the LL-MIP probe is perfect for characterising and delimiting groundwater plumes. If the combined LL-MIHPT probe is used, related information about contamination and hydraulic conductivity is provided in one and the same continuous log. This ensures information about where the contaminant flux is highest and whether any contamination is retained in low-permeable layers that may cause back diffusion in the plume. The log results can be used to target any subsequent water sampling in the high-permeable horizons, e.g. through level-specific water sampling (see later description).

HPT
HPT (Hydraulic profiling tool) penetrates "real time" profiles of the hydraulic properties of the soil in both fine and coarse-grained materials. HPT uses a sensitive transducer which measures the counter pressure in the soil by injecting water. HPT is mainly used to localise and delimit preferential migration pathways for contaminants in the soil, and a hydrostatigraphic model can be built, which is crucial for understanding both water and contaminant transport. Moreover, HPT can be used to identify depth intervals for permanent Geoprobe® filters, identify depth intervals for slug tests and measure vertical pressure gradients through a profile. This allows the water exchange between aquifers to be assessed and, under optimum conditions, the flow direction of the groundwater to be determined. HPT can also be used to identify suitable zones for injecting chemical reagents in connection with in-situ remediation projects.

Conductivity
Under certain circumstances, it is possible to separate materials such as clay and sand by means of an EC conductivity probe, and EC data can help with the interpretation of the geology together with HPT data. One advantage of EC data is that they very clearly identify any unsaturated soil layers. It is possible to map out the added reagents and their vertical distribution when reagents are injected for e.g. chemical oxidation or stimulated reductive dechlorination. The reason for this is that the reagents will result in strongly increased conductivity in the pore water and thus create a considerable contrast compared with the natural conductivity in the soil. During injection projects, it will thus be possible to perform regular tests of the distribution achieved and possibly adjust the strategy. A chloride or similar tracer can be added so that the injected fluid is easier to identify with EC data.

Level-specific water sampling
Sampling of groundwater using the Geoprobe® system offers an efficient and flexible alternative to sampling from conventional drilling and is particularly suitable for vertical and horizontal delimitation of groundwater plumes. Groundwater samples can be taken at one or several depths in the same push and without leaving unnecessary filters. During the purging of the filter, parameters such as oxygen, temperature, conductivity, pH and redox potential can be measured. Using NIRAS' own slug test equipment, it is also accurately possible to determine the hydraulic conductivity in the aquifer directly in the water sampling filter.

Intact core soil samples
As a supplement to MIP, HPT and conductivity probing, intact soil core samples can be taken at specific levels. The soil core samples can be taken as continuous cores from the terrain or be taken at specific levels. NIRAS offers several systems for sampling of soil cores in PE liners, e.g. Makro-Core and Dual-Tube. The Dual-Tube system also allows taking sporadic samples of groundwater at the same time as the soil sampling. Moreover, it is possible to install a groundwater filter after the core samples have been taken.

Level-specific soilgas sampling
Soil gas samples can be taken at specific depths or as depth profiles from the terrain. It is thus possible to gain an overview of the location, extent and migration pathways of the contamination through the unsaturated zone. The soil gas sample is taken as a bag sample, on activated carbon tubes for accredited analysis or on traps which will then be analysed in NIRAS' own mobile laboratory. On site, it is possible to measure e.g. PID, oxygen, carbon dioxide and methane in the soil gas. This may help clarify the level of biological activity.

LIF – Laser-induced fluorescence
NIRAS uses a measuring probe based on UV fluorescence to identify oil products that contains consistent fractions of PAH's. Since all PAHs fluoresce under UV light when present at residual phase concentrations, and have different wave-length response, it is possible to determine the type of oil product and its volume. This method allows for a very fast screening, and gives reliable information about vertical and horizontal distribution of typical oil products like gasoline and diesel.

OTHER SERVICES

- FLUTe liner installation to demonstrate free-phase oil and chlorinated solvents
- Screening of Ø12-63 mm PE and PVC filter tubes
- Screening using pre-packed filters for both groundwater and soil gas
- Injection of various reactants such as ZVI, KB1, bacteria and oxidants
- Injection of chloride, bromide, DKP tracers
- Installation of Sorbisense flux meters
- Installation of PVP (Point Velocity Probes).

Lars Prinds Hedegaard
Team Director, Geoprobe
T: +45 4810 4363
E: lph@niras.dk

Anders G. Christensen
Expertise Director
T: +45 4810 4405
E: agc@niras.dk

NIRAS
Sortemosevej 19
3450 Allerød
Denmark

April 2018