

TO Environmental Cleanup and Brownfield Program Managers

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SUBJECT Utilization of Direct Push Technology

Direct Push Technology (DPT) devices are investigative tools that drive or ‘push’ small-diameter rods into the subsurface via hydraulic or percussive methods without the use of conventional drilling. DPT has been in use in the environmental industry for more than two decades and its utilization as a tool for performing subsurface investigations in Pennsylvania and many other states has grown concurrently with its evolving technology.

The Pennsylvania Department of Environmental Protection’s (PA DEP) Groundwater Monitoring Guidance Manual, last published in 2001, summarizes the minimum construction standards of monitoring wells to be installed in the Commonwealth. However, DPT utilization for monitoring well installation is not referenced in the guidance. This memorandum is therefore intended to provide guidance regarding the use of DPT for subsurface groundwater investigations at remediation sites.

Monitoring wells installed using DPT can either be field-constructed, similar to conventionally drilled and installed wells, or installed using pre-packed well screens. The pre-packed well screen assemblies consist of an inner slotted screen surrounded by a wire mesh sleeve which acts as a support for filter media (sand). The sand is packed between the slotted screen and the mesh. Due to quality assurance concerns regarding field-construction and associated problems placing the filter pack around the screens of small-diameter wells, only DPT pre-packed wells are considered suitable for remediation sites in Pennsylvania.

Limitations of DPT

DPT cannot completely replace the use of conventional drilling/monitoring well installation as limitations of the technology are evident in certain situations. DPT is only useful at generally shallow depths (less than 100 feet below surface grade) and in unconsolidated formations. DPT is not suitable for formations containing excessive gravel, cobbles, boulders, etc., or for bedrock drilling due to the obvious lack of augering capabilities. At sites where there exists a potential for flowing sands, DPT should not be utilized. Each time the string of rods are removed from the borehole for sampling purposes, the lack of a coherent sand lens in the strata would cause the borehole to collapse.

DPT is inappropriate for monitoring well installation below confining layers or as 'nested' wells. Since DPT does not provide for the advancement of casing to keep the borehole open and seal off each separate zone of saturation, DPT can potentially allow for the mixing of separate zones of saturation when the push rods are withdrawn from the borehole. Therefore, the threat of cross-contamination from separate zones of saturation above clean zones of saturation is great.

If large volumes of aqueous sample are required, DPT installed monitoring wells may not be suitable due to the small diameter of the well screen.

Since DPT causes smearing and compaction of the borehole sides, proper well development techniques are vital to ensure that natural hydraulic permeabilities are maintained. Several studies have demonstrated that hydraulic conductivities can vary by an order of magnitude lower for wells installed by DPT versus wells installed by conventional hollow stem auger (HSA). Therefore, great care needs to be taken to ensure adequate well development when using DPT for well installations.

Proper well development is critical in order to collect samples that accurately represent groundwater quality. There is a concern whether DPT wells can be properly developed as per PA DEP's Groundwater Monitoring Guidance Manual. Concern also exists regarding the durability of DPT wells for the purpose of attainment sampling (i.e. eight quarters of sampling).

Advantages of DPT

Depending on site conditions, DPT offers an attractive alternative to conventional auger drilling and split spoon sampling. The smaller size of DPT rigs enables well installation and sampling in areas not accessible to traditional large auger rigs.

As DPT methods utilize a smaller diameter boring than conventional drilling, less solid waste is generated. Similarly, less liquid waste will be generated from smaller diameter monitoring wells.

Overall, there is minimal disturbance to the natural formation using DPT in comparison with auger drilling.

From an economic standpoint, DPT has several advantages versus conventional drilling. In relation to project schedule and budget, the time-effectiveness of DPT installation may enable the remediator to investigate more areas of a site than traditional HSA drilling would allow. Less well construction materials may enable a remediator to install additional monitoring points on a limited budget.

Most importantly, short-term and long-term groundwater monitoring studies conducted by others have produced results demonstrating that water samples collected from DPT installed wells are comparable in quality to those obtained from conventionally constructed wells.

Conclusions

In summary, DPT pre-packed wells can be beneficial and approvable for remediation sites assuming proper well installation protocol is followed. This includes adequate well development, utilization of low-flow purging and sampling, decontamination of drilling equipment, and prevention of a hydraulic conduit where confining layers are present.

The following should also be considered:

- It is recommended that the use of DPT pre-packed wells for characterization and/or attainment sampling should be discussed by the consultant and the DEP project manager/geologist prior to installation to determine appropriateness of the technology at each site application.
- Field-constructed DPT wells are not suitable for characterization and attainment sampling. Due to limited annular space surrounding the well screen, proper construction of the well cannot be assured.
- Two-inch diameter, pre-packed screened wells should be utilized. One-inch diameter wells are not acceptable.
- DPT installed wells are not suitable for aquifer testing (e.g. pump testing, slug testing).
- All field collected well development water quality data should be submitted to the DEP project officer to assure stabilization and proper well development.
- DPT pre-packed screened wells may be used for characterization and/or attainment groundwater quality sampling. However, if further groundwater investigative or remedial activities are required at that location, or if the DPT installed wells do not provide adequate durability, the installation of conventional monitoring wells would be required at an adjacent location.

References

American Society for Testing and Materials (ASTM), Standard Practice for Direct Push Installation of Prepacked Screen Monitoring Wells in Unconsolidated Aquifers, ASTM-D6725-04, 2010.

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