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In Situ Remediation using Horizontal Wells

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IN SITU REMEDIATION USING HORIZONTAL WELLS

THE NEED

Underground fuel storage tanks have become a nightmare for thousands of businesses, including contractors. Leaking tanks will contaminate soil and groundwater not only at owner's site, but also beneath adjoining property. Remediation using traditional methods of access, such as vertical wells directly over the plume, disrupts activities on the site, and sometime access directly over the contamination is impossible. The cost of such method is also considered high.

THE TECHNOLOGY

Horizontal well technology has been widely used in petroleum and underground utility installation. Since late 1980's, the technology has been adapted for environmental remediation applications.

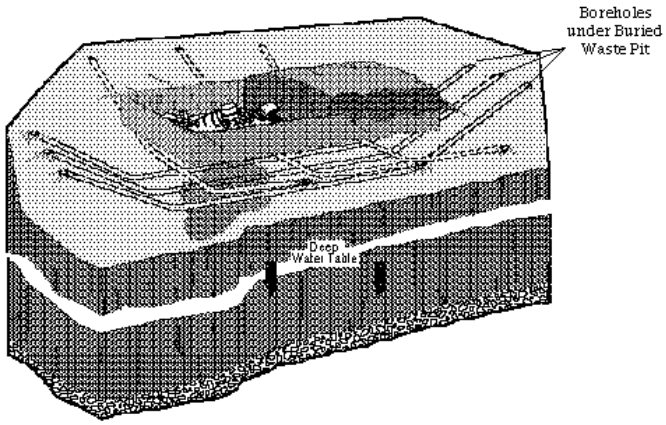

FIGURE 1 DIRECTIONAL DRILLING

The method of drilling the horizontal well can begin in vertically or directionally at the ground surface and then proceeds horizontally to a depth and length depending on desired installation parameters. Two general methods in drilling horizontal wells have been used in remediation, trenched and directionally-drilled. The first method involves the excavation of a relatively large diameter borehole, with simultaneous installation of well materials and backfill. The second method, directional drilling, produces a smaller diameter borehole and well materials are installed following the completion of drilling activities.

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- Fiber reinforced plastic (FRP)
- Fiberglass reinforced epoxy(FRE)
- High density polyethylene (HDPE)
- High temperature polyethylene (HTPE)
- Polyvinyl chloride (PVC)
- Stainless steel
- Porous polyethylene well screen

This technology can be used in the application of various remediation techniques such as ground-water and/or non-aqueous phase liquid extraction, air sparging, soil vapor extraction, in situ bioremediation, in situ flushing, treatment walls, hydraulic and pneumatic fracturing, etc. This technology is very useful when contaminant plume covers a large area and has linear geometry, or when surface obstructions are present. The costs of horizontal well installation varies depending on many site specific factors, the range is from $25-$85 per foot, while the average cost of horizontal directional drilling for regular utility installation is between $10 - $20 per foot.

The Benefits

- Horizontal well screens contact a larger surface area of contaminated media thereby enhancing remediation of a greater volume of contaminated media per well.
- Horizontal wells need less wells than vertical wells.
- A horizontal well configuration allows better access to/contact with linear plumes.
- Installation can be completed with minimal disturbance to surface operations.
- Directionally drilled horizontal well can be installed under building and other obstructions.

Status

Over 300 horizontal wells have been installed for environmental remediation in US. Horizontal well technology has been accepted by the EPA, DOD, DOE, the New Jersey-New York Port Authority, the petrochemical industry, and most state environmental regulators. The leaders in developing remediation procedures for directional boring equipment are, among others, the Charles Machine Works, Inc. (CMW) which manufactures Ditch Witch underground construction equipment and Vermeer Manufacturing Company which produces Navigator directional boring machines.

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BARRIERS

Based on the technology overview report of Ground-Water Remediation Technologies Analysis Center (GWRTAC) on horizontal wells, limitation of trenched wells include:

- This method needs disposal of contaminated soil which is considered to be expensive
- Inability to be installed beneath building due to potential instability resulting from undercutting.
- Installation lengths may be limited by underground utility lines since precise steering around such obstacles is not possible.
- Well installation cannot proceed in hard rock.

General limitation of horizontal wells:

- Not applicable for light non-aqueous phase liquid (LNAPL) recovery in area with large water table fluctuations.
- Well installation depths can be limited.
- Vertical capture zone is limited by the vertical hydraulic conductivity, which is usually significantly lower than horizontal conductivity.

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REVIEWERS

Peer reviewed as an emerging construction technology

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