

1-1-2007


Funnel & Gate System

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DOI: 10.5703/1288284315897

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Recommended Citation

ECT Team, Purdue, "Funnel & Gate System" (2007). *ECT Fact Sheets*. Paper 188.
<http://dx.doi.org/10.5703/1288284315897>

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FUNNEL & GATE SYSTEM

THE NEED

To clean the contaminated soil and groundwater more efficiently, reactive barriers can be used to treat a variety of organic compounds and heavy metal contamination using specialty engineered media or bio-organisms. But, the limited success and high cost of traditional 'active' ground-water-contaminant plume management efforts (i.e., pump-and-treat systems) has stimulated a search for less expensive 'passive' plume interception and in-situ treatment technologies. The 'funnel and gate system,' which uses heterogeneous (surface-mediated) reactions on porous media to degrade dissolved contaminants, is one passive technology under consideration.



FIGURE 1 FUNNEL AND GATE SYSTEM EXCAVATION

THE TECHNOLOGY

A funnel and gate system is a passive remediation method which utilizes cutoff walls (the funnel) to modify flow patterns so that ground water flows primarily through high conductivity gaps (the gates).

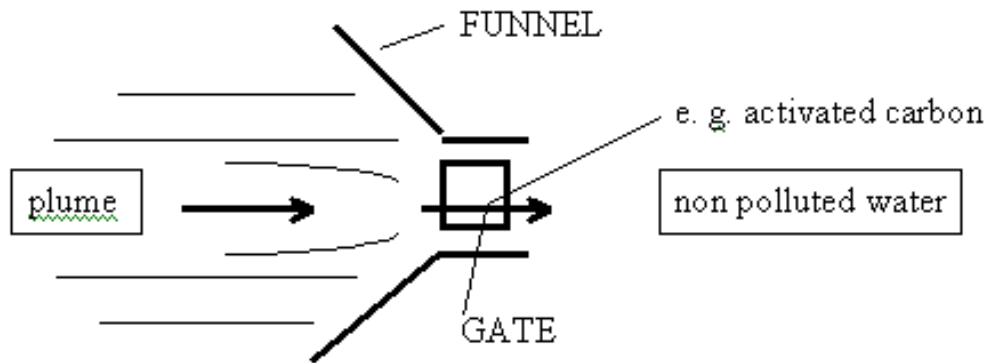


FIGURE 2 REMEDIATION SYSTEM OF THE FUNNEL AND GATE SYSTEM

The system would have to extend to depths of 60 to 70 feet, with at least 25 feet of this depth in the very dense weathered rock zone. And it can be installed at the front of plumes to prevent further plume growth, or immediately down gradient of contaminant source zones to prevent contaminants from moving into plumes.

The non-permeable funnel serves to lead the contaminated groundwater to the highly permeable gate which contains a reactive agent (e.g., iron granules), and as groundwater flows through (in the absence of oxygen), the chlorinated solvents are transformed into innocuous components. With these a biotic, biological and/or physico-chemical processes, contaminants are destroyed or degraded resulting in non-toxic chloride and simple hydrocarbons, which are further reduced by naturally occurring bacteria (see above figure). The groundwater leaving the gate is decontaminated.

THE BENEFITS

The significant advantage of the funnel and gate system is that they can be effective without pumping, mass excavation of contaminated soil, above-ground treatment facilities or off site disposal. And contaminated groundwater can be steered, under the influence of the current natural groundwater flow and isolation walls (funnel), through a controlled reactive zone in the soil (gate). The ongoing operation and maintenance costs are comparatively low than other alternatives 'pump-and-treat' Over the long term, funnel-and-gate technology costs about 50% less, depending upon the site-specific variables with little or no maintenance for long periods. In addition, the system does not require aboveground structures, so use of the property is not restricted.

STATUS

A reactive zone can be considered as a compact, permeable in-situ 'reactor', in which the collected groundwater is remediated in various ways. Since biological as well as chemical and electro-kinetic remediation techniques can be applied, if required in combination, the concept is widely applicable for a



wide range of contamination. The funnel and gate installations often use slurry cutoff walls as wingwalls to funnel groundwater into a permeable reactive barrier or gate. Slurry cutoff walls can also be used to encircle contamination and permit a single vessel of permeable reactive media inside the containment to economically treat a controlled volume of groundwater. Special bacteria or high carbon fly ash can be added to the soil-bentonite slurry cutoff wall to create an impermeable reactive barrier. As the first commercial permeable reactive barrier, the funnel and gate used cement bentonite and soil cement bentonite slurry walls to funnel ground water through an iron filing gate was installed in 1994 on a congested industrial site in California. Subsequent to the installation of the optimized Funnel and Gate system, the various remediation techniques will be tested and assessed.

BARRIERS

Comparing the traditional technologies such as pump-and-treat, the funnel-and-gate system is more expensive to install. Though the ongoing operation and maintenance costs for other alternative are comparatively high, the cost saving of the funnel-and-gate system should be verified. The efficiency of reactive barrier installations significantly depends on controlling the flow of groundwater through the media.

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REVIEWERS

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PUBLISHER

Emerging Construction Technologies, Division of Construction Engineering and Management, Purdue University, West Lafayette, Indiana