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Waterloo Emitter™

Model 703 Data Sheet

Waterloo Emitter™

The Waterloo Emitter is a simple, low cost device designed for the controlled and uniform release of oxygen, or other bio-enhancing amendments, to encourage and sustain the growth of microorganisms required for in-situ bioremediation of contaminated groundwater.

The patented technology* enables steady, direct diffusion of oxygen into an aquifer through pressurized silicone or LDPE tubing. Continuous, consistent release of oxygen into the tubing creates the ideal concentration gradient driving this passive system, without 'bubbling off' excess oxygen.

Emitters are ideal for the bioremediation of BTEX and MTBE using oxygen. The diffusive process provides immediate bioavailability of molecular oxygen for aerobic biodegradation enhancement, therefore no loss of the amendment gas occurs. The Waterloo Emitter can also encourage desirable abiotic reactions (pH adjustment, hydrolysis, etc.).

Simple Versatile System

Waterloo Emitters are available to fit 2", 4" and 6" (50 mm, 100 mm and 150 mm) wells. They can be installed in open wells, or they can be permanently installed with sand packs in boreholes or trenches. The 51" (130 cm) long Waterloo Emitters can be installed individually or stacked one on top of another, to ensure full coverage of the contaminant plume. They are also effective in horizontal applications.

Because there is no minimum hydraulic head required, the Emitters are effective at any depth below water. When used in conjunction with packers and/or circulating pumps, the radius of influence is increased.

The Waterloo Emitter's unique diffusive technology allows for the use of almost any chemical as an amendment to treat contaminated groundwater. The PVC frame accommodates the insertion of monitoring or sampling devices for observing groundwater conditions during the remediation process.

Applications

- Oxygen release for aerobic bioremediation of BTEX and MTBE
- Hydrogen release for anaerobic reductive dechlorination of solvents
- Introduction of dissolved SF6, argon, etc. for use as tracers
- Release of CO2 for pH adjustment
- Light alkane release to promote co-metabolic biodegradation of MTBE
- Plume migration barrier, primary remediation device, or polishing

1.8", 3.8" & 5.8" Waterloo Emitters

Operating Principles

The Waterloo Emitter consists of silicone or polyethylene tubing coiled around a PVC frame. When a fluid is introduced into the tubing a concentration gradient is created between the inside of the tubing and the groundwater.

The Emitter works in accordance with Fick's Law, whereby diffusion will occur until there is equilibration in chemical concentration inside and outside of the tubing. With the Emitter technology, the oxygen (or other amendment) is replenished continuously, and as groundwater continues to flow around the Emitter, equilibration never occurs. This results in continuous diffusion from the Emitter into the groundwater.

When a gas is applied to the Emitter there is a direct correlation between an increase in applied pressure and an increase in the amount of gas that will diffuse into the groundwater, however, diffusion is the only mechanism that allows the amendment to be added to the groundwater.

Advantages

- Low cost
- Steady release for constant microbial activity
- Easy installation and removal
- Minimal maintenance and operating effort
- No amendment loss due to 'bubbling'
- No hazardous substances introduced or produced
- No slurry to mix, handle or inject
- No electricity required

*U.S. Patent # 5,605,634

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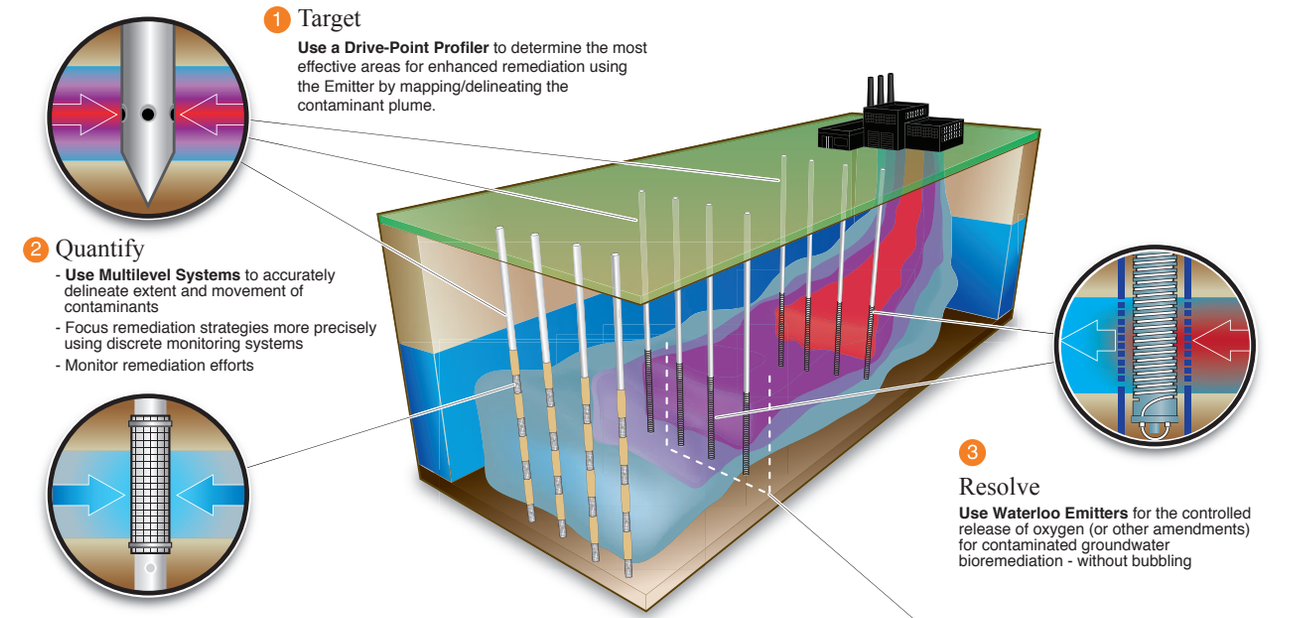


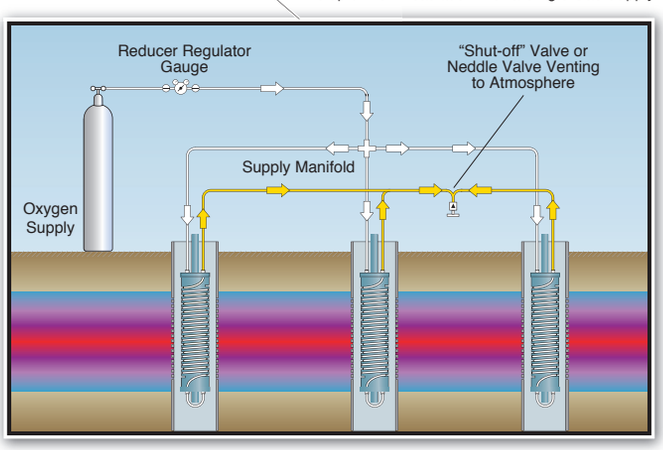
Schematic showing staged plume remediation using Waterloo Emitters, monitored by a transect of CMT or Waterloo Multilevel Systems placed down gradient.

Installation

If an enhancement gas is to be used for remediation, a small to medium sized gas cylinder can be used. Emitter tubing is selected and pressure is set according to the amount of enhancement gas required. A single gas cylinder can be used to supply multiple Emitters connected in series.

Replenishment of the gas inside the Emitter tubing can be accommodated by periodic purging (weekly/bi-weekly), or a needle bleed valve can be used at the end of the system to allow slow, constant replenishment to occur.

Multiple Well Installation with a Single Gas Supply



BTEX TPH Remediation Case Study

In 2007, Emitters were installed to clean up a former gas station site in Guelph, Ontario. The contaminant plume containing gasoline and diesel occurred in unconsolidated silty sand to a depth of approximately 3 m (10 ft). The initial plume stretched 30 m (100 ft) long and 15 m (50 ft) wide.

Migration towards down gradient receptors was a concern; therefore a solution that worked quickly and effectively was required to help eliminate the potential for exposure. A total of 14 Waterloo Emitters using LDPE tubing were installed in 4" wells screened at and below the water table. Emitters were placed to form a "fence" along the down gradient property boundary to cut off the contamination plume. Dried air containing 21% oxygen was released through the tubing.

During the remediation process, Dissolved Oxygen (DO) samples were collected on a monthly basis and groundwater samples for BTEX and TPH were collected quarterly from down gradient wells. Within one month of the installation, DO levels in the monitoring wells increased an average of 880%.

Initial TPH levels were a maximum of 27 mg/L (average 9.6 mg/L) and initial BTEX levels were approximately 11 mg/L. Within six months, results showed that the levels of BTEX and TPH had dropped below the analytical detection limit, meeting the Soil, Ground Water and Sediment Standards of the Ontario Environmental Protection Act, thus enabling the Emitter system to be decommissioned just one year after the installation.

Please visit the Solinst Website for more case studies, papers and resources

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