

## **BaroBall™**

**The BaroBall control valve allows natural soil gas to flow out of an underground well, while restricting air flow from the surface into the well.**



BaroBall™, Standard and Inverted

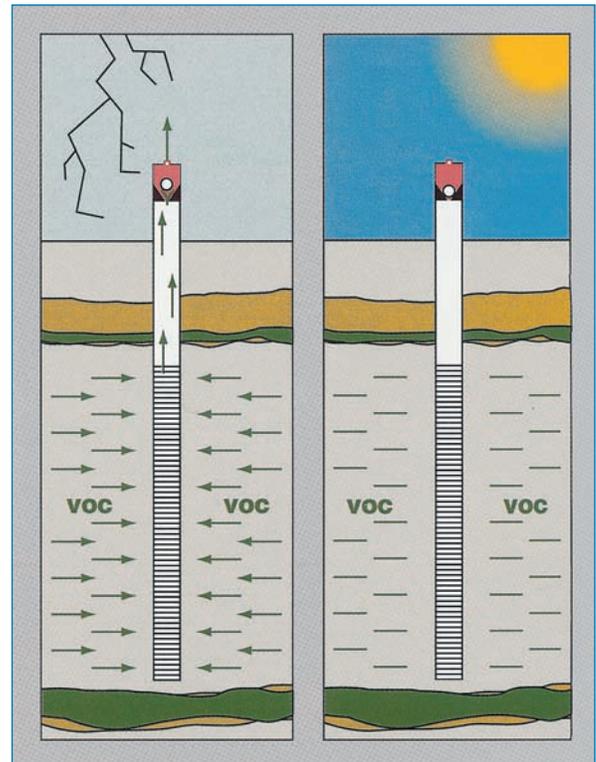
### **Benefits:**

- ❖ **Increase efficiency.** Compared with ordinary passive venting, BaroBall may double the rate of contaminant removal by preventing the dilution of contaminants with fresh air from the surface.
- ❖ **Can be used in multiple flow configurations.** The BaroBall can be modified for gas extraction or air injection, permitting barometric pumping to be used for plume control or oxygen injection in bioremediation systems.
- ❖ **Increases the accuracy of soil gas measurements.** The BaroBall prevents surface air from entering a well and diluting gas concentrations in the subsurface. This allows retrieval and analysis of actual ambient soil gas concentrations.
- ❖ **No power source or pressure sensing required.** The BaroBall is actuated and sustained by the naturally produced pressure gradients between the surface and subsurface.
- ❖ **Rugged, durable construction.** The BaroBall has only one moving part. Unattended operation for an extended period of time can be expected.
- ❖ **High skill level not required for installation.** The BaroBall can be properly installed by any field technician.
- ❖ **Small and unobtrusive.** The BaroBall is cylindrically shaped, three inches in diameter and approximately three inches tall (76 x 83 mm). It can be installed with a low profile and will not stand out from the surrounding landscape.

### **Applications:**

Passive Soil Vapor Extraction and in situ bioremediation.

The BaroBall is a low-cost, low maintenance valve that responds to the natural fluctuations of atmospheric pressure to enhance significantly the removal of volatile organic compounds from contaminated sites that use barometric pumping as a remediation technique.



Atmospheric pressure lower than pressure in the well: VOCs can escape.

Atmospheric pressure higher than pressure in the well: VOCs cannot escape.

## Description:

The BaroBall™ is a patented\* control valve that harnesses natural fluctuations in atmospheric pressures to create a pumping method that passively removes vapors from the unsaturated soil zone (Passive Soil Vapor Extraction). This technology has been demonstrated at the Savannah River National Laboratory to increase removal rates by up to 50%. Natural atmospheric pressure fluctuations are transmitted through the unsaturated subsurface resulting in pressure differential between the surface and subsurface. When the zones are directly connected by a well placed in the vadose zone, the pressure differentials will result in flow into or out of the well depending on the BaroBall configuration used.

The BaroBall is installed at the top of the well casing to permit gas flow in one direction. The BaroBall has been used in conjunction with the FAP Plus™ pump during LNAPL recovery. The addition of the passive SVE can improve LNAPL recovery depending on the soil and site conditions. Other applications include the final polishing for an active SVE system where removal rates have been substantially reduced to the point where SVE system operation costs are very high. Inverted BaroBall installations have been used to allow air flow into the subsurface, but prevent air escape to improve in-situ bioremediation.

The BaroBall has been used to provide plume control of methane production at landfills. It can be used with the SolarSPARGE for sparging.

## Operation:

Use of barometric pumping to remediate contaminated soils is growing as a finishing technique when active extraction is no longer cost effective due to low contaminant diffusion. It also is used as an interim measure or when funds are unavailable for more expensive systems.

While check valves are currently available, none is suitable for the low pressure requirements of a barometric pumping system. The cracking pressure of these valves is typically seven to 10 millibars, much higher than could be produced by natural pressure differences.

Electrically operated valves are available but are undesirable because of their high costs and maintenance.

The BaroBall conforms to the low-cost, low-maintenance philosophy of barometric pumping through its simple construction, use of low-maintenance, durable materials and its ability to be used for extended, unattended operations. It now allows the remediation of many sites whose pollution levels do not justify the use of currently available, costly remediation technologies.

## SPECIFICATIONS

Input Power	Natural atmospheric pressure fluctuations
Cracking Pressure	As little as on millibar change in atmospheric pressure
Operating Temperature	Ambient air temperature of -40°F to +140°F (-40°C to +60°C)
Remediation Rate	Site specific. Typical flow rates of 0.1 to 1.0 scfm (0.05 to 0.47 dm <sup>3</sup> /s)
Size	Designed to slide into a 2-in PVC Sch 40 casing. Thread Connection: 1 inch NPT. May be fitted to larger wells by using common PVC adapter fittings.
Max. Well Depth	Site specific. To the top of the water table.
Dimensions	3-in diameter x 3.25-in length (76 x 83 mm)

## ORDERING INFORMATION

TR-965	Standard BaroBall™ for soil gas extraction	2 lb
TR-966	Inverted BaroBall™ for atmospheric air injection	2 lb

### Accessories:

BaroBall can be used on all kinds of vadose zone wells with appropriate reducer or expander pipe sections. Not supplied.

## Common Questions:

### *On what size well can the BaroBall be installed?*

Any size well will accommodate installation. The BaroBall's smallest aperture is one inch and will therefore introduce minimal flow losses for barometric pumping systems.

### *What kind of contaminant removal can I expect?*

This depends solely on the concentration of contaminants in the gas and the flow rate through the well. Typical barometric pumping flow rates range from 0.1 to 1.0 scfm (0.05 to 0.47 dm<sup>3</sup>/s) depending on the permeability of the formation, the length of the well screen and the diameter of the well. Flows as high as 10 scfm (4.7 dm<sup>3</sup>/s) have been measured. Removal rates as high as 2.2 lb (1 kg) per day per well in highly contaminated sites have been measured.

### *How often will the wells be removing contaminants?*

The duty cycle of barometric pumping is 50 percent. If there is another driving force at the site (such as methane buoyancy and pressurization at the landfill) the duty cycle will increase.

BaroBall™ is a trademark of Westinghouse Savannah River Company, LLC.

\* U.S. Patent No. 5,641,245 and 6,425,298 and Canadian Patent No. 2,221,770 have been issued on the BaroBall.