

# IEG Technical Briefing Note No. 5

## Coaxial Groundwater Circulation-Sparging- IEG CGC-Sparge

IEG **Coaxial Groundwater Circulation-Sparging** (IEG CGC-Sparge) is a combination technique which is used for the effective remediation of shallow aquifers and perched groundwaters at depths of up to 3 to 7 metres which are contaminated with a range of volatile organic substances, including petroleum hydrocarbons and solvents.

An IEG CGC-Sparge process unit consists of a specially-designed groundwater well incorporating an IEG double-cased screen, a compressor, a special pressurised air distributor, a low-vacuum extraction system, and a waste air decontamination system (typically regenerative Granular Activated Carbon).

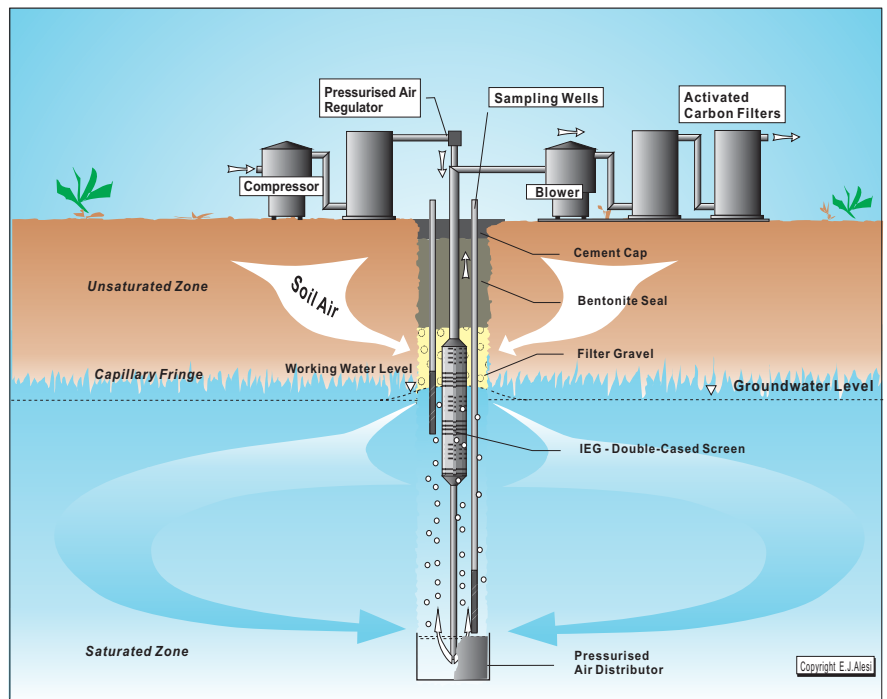
### Principle of Operation

**IEG CGC-Sparge** operates by efficiently combining enhanced soil air venting with in-well groundwater stripping - the “push and pull technique” - to simultaneously remediate the unsaturated zone and underlying aquifer. The **CGC-Sparge** system's significantly enhanced remediation capability stems from the fact that it delivers complete directional control over the injected air at very low pressures and maintains an optimal balance between injected air and extracted volatile contaminants. Clean compressed air is injected in a controlled manner into an IEG pressurised air distributor set in a multi-screened well, the base of which is located between the capillary fringe (the intersection between unsaturated soil and the water table) and the base of the aquifer or contaminated zone, depending on the vertical pollutant distribution. The upper screened section and the IEG double-cased screen straddle the capillary fringe.

The innovative design of the **IEG CGC-Sparge** system provides a controlled directional air sparging effect, regulating the injected air flow so that the air can only flow upward within the well and not laterally outwards within the aquifer, unlike other air sparging techniques.

Consequently, the air bubbles which emanate from the pressurised air distributor rise within the well, causing groundwater inside the well casing to flow upward under the air lift effect.

This air lift effect transports contaminated groundwater to the base of the well, where volatile organic substances which are dissolved in the groundwater are transferred very efficiently from the liquid to the gas phase in an amount that is relative to their gas-liquid distribution coefficient and are extracted to the surface via IEG's special double-cased screen under low negative pressure.



Coaxial Groundwater Circulation-Sparging  
for effective remediation of shallow and perched groundwater  
(IEG CGC-Sparge Process)

Soil air from the unsaturated zone which is drawn into the system is also extracted and remediated. Stripped groundwater is redistributed throughout the aquifer via the screened well section. This causes a continuous circulation of groundwater to be generated in the area surrounding the remediation well, constantly delivering new contaminants to the stripping zone within the well.



**IEG Technologie GmbH**  
Hohlbachweg 2  
73344 Gruibingen

**Tel.: +49 (0) 7335 96 97 6 0**  
**Fax.: +49 (0) 7335 96 97 6 40**  
**www.ieg-technologie.com**

To discuss your in-situ soil and groundwater remediation requirements, or for a free remediation concept and quotation, please contact Dr. Eduard Alesi, email: [eduard.alesi@ieg-technologie.de](mailto:eduard.alesi@ieg-technologie.de)

# IEG Technical Briefing Note No. 5

## Coaxial Groundwater Circulation-Sparging- IEG CGC-Sparge

*continued*

### Advantages

IEG's **CGC-Sparge** system has numerous and considerable advantages over conventional sparging systems:

#### **No Mineral Precipitation**

Controlled vertical groundwater and air flows differentiate the **CGC-Sparge** from other conventional air sparging methods which use high pressure injection. In such circumstances, excess pressure heats the groundwater and consequently leads to significant changes in groundwater geochemistry which dramatically increases the possibility of iron, manganese or carbonate precipitation.

#### **Guaranteed Directional Control**

Conventional air sparging methods rely on high pressure air injection and recovery of air and volatile substances entrained in it by means of satellite recovery wells arranged radially around the sparge point. In layered aquifers, air injected at high pressure will tend to flow laterally away from the point of injection and not upward where it can be recovered, which dramatically reduces recovery efficiency.

Furthermore, in layered anisotropic aquifers, less permeable horizons tend to prevent upward migration of air therefore contaminants tend to stay in the ground. This problem is enhanced at the interface between the water table and the unsaturated zone, which air and volatile contaminants have difficulty in traversing.

#### **High Pressure Drawbacks**

High pressure injection in conventional sparging systems forces air into small pore spaces in the aquifer where it remains, locking in contaminants, which gradually seep back out into the groundwater after system closure.

In addition, with conventional sparging systems, injected air will tend to cause an isobaric pressure sphere around the injection point, which forces groundwater and entrained contaminants away from the recovery system in all directions, including downwards, which can actually lead to contamination of previously clean horizons.

#### **Other advantages include:**

- System is extremely cost efficient.
- A particular feature of the **IEG CGC-Sparge** is its ability to effectively and efficiently remediate the often very highly contaminated capillary fringe.
- In contrast to other conventional air sparging methods, the clean water leaving the upper screen section of the **IEG CGC-Sparge** well has no air bubbles entrained in it.
- No air-water phases can impede groundwater flow in the aquifer.
- Unlike conventional sparging systems, a mass balance can be obtained between influent and effluent air.
- **IEG CGC-Sparge** needs lower pressure, less air volume, and thus consumes much less energy than conventional air sparging methods making it the **more sustainable** option.
- The difficulties that arise during conventional remediation procedures due to contaminated perched groundwater, which collects in the remediation well, do not occur with the **IEG CGC-Sparge**.



**IEG Technologie GmbH**  
Hohlbachweg 2  
73344 Gruibingen

**Tel.: +49 (0) 7335 96 97 6 0**  
**Fax.: +49 (0) 7335 96 97 6 40**  
**www.ieg-technologie.com**

To discuss your in-situ soil and groundwater remediation requirements, or for a free remediation concept and quotation, please contact Dr. Eduard Alesi, email: [eduard.alesi@ieg-technologie.de](mailto:eduard.alesi@ieg-technologie.de)