



Brilliant Environmental Services, LLC (*Brilliant*) is a full-service environmental consulting and contracting firm, integrating today's technologies for tomorrow's solutions. Headquartered in New Jersey, *Brilliant* specializes in investigation, remediation, brownfields redevelopment, and underground storage tank services. *Brilliant* is the underground storage tank compliance expert.



**Dual-Phase Extraction
Multi-Phase Recovery (MPR) is Successful in Removing
Separate-Phase Product from the Subsurface
Brilliant's MPR Units are Available for Operation on Your Site**

Dual-phase extraction, also known as multi-phase extraction, vacuum-enhanced extraction, or bioslurping, is an in-situ technology that uses pumps to remove various combinations of contaminated groundwater, separate-phase petroleum product, and hydrocarbon vapor from the subsurface. Extracted liquids and vapor are treated and collected for disposal, or re-injected to the subsurface (where permissible). Dual-phase extraction systems can be effective in removing separate-phase product from the subsurface, thereby reducing concentrations of petroleum hydrocarbons in both the saturated and unsaturated zones of the subsurface. Dual-phase extraction systems are typically designed to maximize

extraction rates; however, the technology also stimulates biodegradation of petroleum constituents in the unsaturated zone by increasing the supply of oxygen, in a manner similar to bioventing.

DPE systems often apply relatively high vacuums to the subsurface. Thus, the adjective "high-vacuum" is sometimes used to describe DPE technologies, even though all DPE systems are not high-vacuum systems. DPE technologies can be divided into two general categories, depending on whether subsurface liquid(s) and soil vapor are extracted together as a high-velocity dual-phase (liquid(s) and vapor) stream using a single pump or whether the subsurface liquid(s) and soil vapor are extracted separately using two or more pumps. Single-pump systems rely on high-velocity airflow to lift suspended liquid droplets upwards by frictional drag through an extraction tube to the land surface. Single-pump vacuum extraction systems can be used to extract groundwater or combinations of separate-phase product and groundwater. The somewhat more conventional dual-pump systems use one pump to extract liquids from the well and a surface blower (the second pump) to extract soil vapor.

Single-pump DPE systems represent a recent adaptation of this long-established technology to the task of subsurface remediation. Single-pump DPE systems are generally better suited to low-permeability conditions, and they are difficult to implement at sites where natural fluctuations in groundwater levels are substantial. Single-pump DPE technology is sometimes referred to as bioslurping. Dual-pump DPE systems are simply a combination of traditional soil vapor extraction (SVE) and groundwater (and/or floating product) recovery systems. Dual-pump systems tend to be more flexible than single-pump systems, making dual-pump systems easier to apply over a wider range of site conditions (e.g., fluctuating water tables, wide permeability ranges); however, equipment costs are higher.

The vacuum applied to the subsurface with DPE systems creates vapor-phase pressure gradients toward the vacuum well. These vapor-phase pressure gradients are also transmitted directly to the subsurface liquids present, and those liquids existing in a continuous phase (e.g., water and "free" petroleum product) will flow toward the vacuum well in response to the imposed gradients (the term "free" product is a commonly used, though imprecise term because a greater fraction of resident petroleum product may be recovered using vacuum-enhanced DPE compared to the fraction of product recoverable using gravity drainage alone). The higher the applied vacuum, the larger the hydraulic gradients that can be achieved in both vapor and liquid phases, and thus the greater the vapor and liquid recovery rates.

The depressed groundwater table that results from these high recovery rates serves both to hydraulically control groundwater migration and to increase the efficiency of vapor extraction. The remedial effectiveness of DPE within the zone of dewatering that commonly develops during DPE application should be greater than that of air sparging due to the more uniform air flow developed using DPE.

Brilliant's staff and operators will work with you to assure that your events whether pilot studies, product recovery or remedial action implementation provide you with the most efficient, cost effective and productive results. *Brilliant's* fleet of units

allow us to meet your needs and time constraints so contact us today. Contact [Jon Libourel](#) at (732) 818-3380.

BRILLIANT CAN ASSIST YOU!

Brilliant is your advocate in identifying all of the options available to you...not just what's on the surface; affording you high-quality, personalized service without the high cost. We remain available and mobile to address any size project and prepared to meet with you to discuss your environmental needs. Call us today at (732) 818-3380 or [email us](#).



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