INNOVATIVE SOIL AND GROUNDWATER REMEDIATION

ACCELERATED REMEDIATION TECHNOLOGIES, LLC (ART)
INTEGRATED REMEDIATION SYSTEM

1.0 Introduction

Numerous technologies have been implemented at sites worldwide to remediate contaminated groundwater. Some of the most commonly used technologies such as air sparging, soil vapor extraction and ex-situ (above-ground) air-stripping are based on the physical removal of contaminants; however, significant shortcomings are inherent with each method. A remediation technology that combines the advantages of air sparging, soil vapor extraction and air-stripping plus in-situ active treatment (e.g. bioremediation) would be more effective. This technology would compensate for shortcomings associated with pump-and-treat such as long project life and costs of water disposal and the deficiencies related to air sparging such as a limited radius of influence and removal rate.

2.0 ART Integrated Remediation System

Accelerated Remediation Technologies, LLC (*ART*) has developed an innovative, proprietary remediation technology that is based on well-proven and established concepts. The *ART* technology combines in-situ air stripping, air sparging, soil vapor extraction and enhanced bioremediation/oxidation in an innovative wellhead system. The system is designed to accommodate a four inch well (minimum) and be very cost effective when compared with other remediation technologies.

2.1 Technical Description

The ART technology combines in-situ air stripping, air sparging, soil vapor extraction and enhanced bioremediation/oxidation – plus, Dynamic Subsurface Circulation™ in an innovative wellhead system. Figure 1 (below) illustrates the combined remediation concepts and their effects in the subsurface.

The air sparging component results in reduced water density and lifting (mounding) of the water table in the vicinity of the well. This in turn causes a net negative gradient to the well resulting in water flowing back towards the well. This upwelling force created by the sparging results in an in-well “packer” concept resulting in pressure gradient from the lower screened interval to the upper screened interval that assists in driving the Dynamic Subsurface Circulation forces.

Vacuum pressure (the vapor extraction component) is applied atop of the well point to extract vapor from the subsurface. The negative pressure from vacuum extraction creates additional water mounding, boosts the net gradient back towards the well and removes vapors from the unsaturated zone and well annulus. The SVE and sparging technologies combined in the same well further enlarge the radius of influence.

A submersible pump is placed at the bottom of the well to re-circulate water to the top for downward discharge through a spray head. The water cascades down the interior of the well and system piping, providing multiple wetted surfaces for mass transfer - similar to what occurs in a packed-column air-stripping tower. Enhanced stripping via air sparging near the bottom of the well occurs simultaneously. In essence, the well will act as a subsurface air-stripping tower. In addition to the air stripping resulting from the pumping/cascading, the pumped, stripped, highly oxygenated water will flow down the well annulus and over the mounded water back into the aquifer and vadose zone – hydraulically enhancing the radius of influence. These combined synergistic technology effects will set up a circulation zone surrounding the well that will further

enhance cleanup.

In summary, contaminants are stripped from the water as a result of the combined effects of in-well air stripping and in-well air sparging. The "radius of results", or Dynamic Subsurface Circulation™ cleaning zone, will be created by a combination of negative gradient as a result of air sparging, additional negative gradient resulting from the application of vacuum extraction, and subsurface water circulation induced by a submersible pump. All of these different components can be integrated and installed in a four-inch (minimum) groundwater well.

The ART In-well stripping technology has proven its capabilities at very challenging sites for remediation of chlorinated solvents, hydrocarbons and recalcitrant compounds. The technology is retrofittable to existing systems or can be employed as a new site-wide solution.

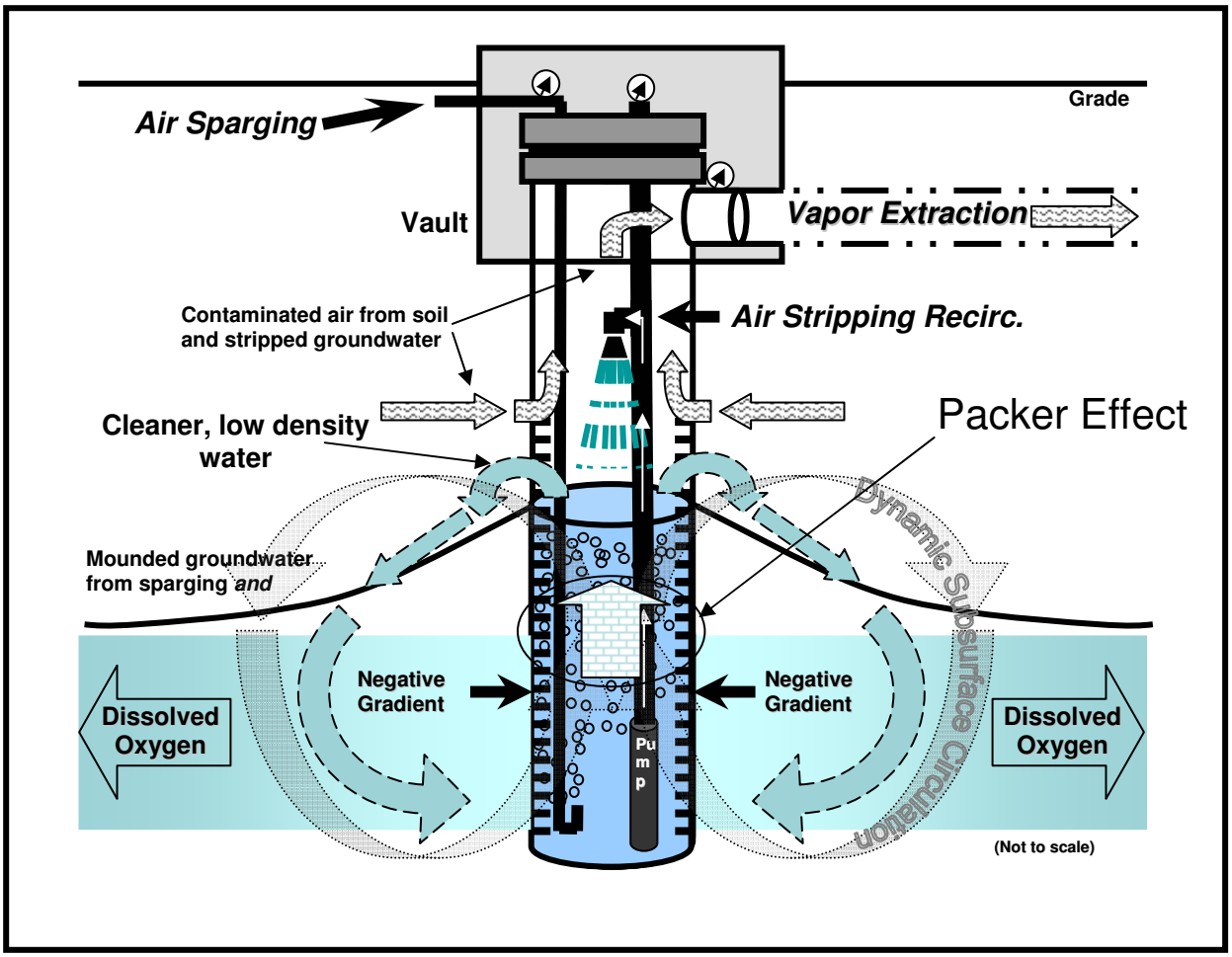

Figure 1