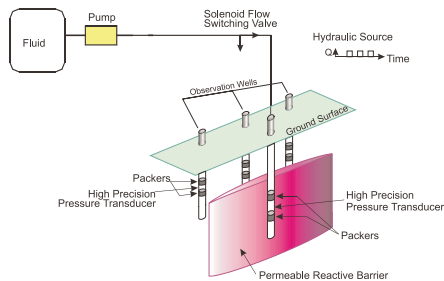


Iron Reactive Barriers

Hydraulic Pulse Interference Test

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GeoSierra has developed specialized equipment and analytical interpretation procedures for hydrogeologic integrity testing of slurry walls and permeable reactive barriers by the hydraulic pulse interference test. The hydraulic pulse interference test is an ideal test for the integrity testing of hydraulic containment systems such as cut off or slurry walls. The test can determine the extent and location of any holes or deficiencies in the wall's hydraulic containment and provided such integrity testing is carried out concurrent with wall construction can enable these deficiencies to be corrected immediately in the field.



Typical Hydraulic Pulse Interference Test Setup

Permeable reactive barrier (PRB) systems are being installed as an alternative method to remediate contaminated groundwater. The most significant difference between a permeable reactive barrier and a containment system is the need to ensure the barrier's permeability does not impede or modify the groundwater flow regimes. The issues such as fines, smearing, filter cake clogging, etc. that benefit slurry wall systems as containment structures have major detrimental impacts on a PRB hydraulic performance. In general, such reduction in PRB permeability can not be retroactively removed and in certain construction techniques are difficult to avoid. Since any impediment to flow by a PRB system can have serious consequences to overall system performance, it is imperative to conduct hydraulic integrity testing of such a system to ensure it is constructed as planned.

The equipment consists of high precision pressure transducers, constant flow rate pump and solenoid adjustable valves, packers and a high speed data acquisition system. Analytic and type curve analyses are available for the interpretation of the hydraulic pulse interference test in a variety of formations.

The pulse interference test requires monitoring wells installed on both sides of the wall or barrier; however, such monitoring wells are generally required as part of the verification and long term performance monitoring of the system.

Hydraulic pulse interference tests conducted across a barrier's alignment prior, during and after construction provide a simple means of quantifying the barrier's hydraulic characteristics and enable detailed quality assurance of the barrier during construction. An iron PRB was constructed within a confined aquifer system from a depth of approximately 45 feet bgs down to a total depth of 110 feet bgs. The PRB was installed by the azimuth controlled vertical hydraulic fracturing technology and as a part of the quality assurance program on barrier hydraulic performance, pre and post construction pulse interference tests were conducted across the PRB alignment from pulse wells located 25 feet up and down gradient from the PRB. Pre and post PRB construction pulse interference test results are shown on the figure below. The receiver well pressure response, amplitude, signature and time delay, shows no attenuation when comparing pre- and post- construction tests. These tests confirm that the PRB has an in placed hydraulic conductivity of at least that of the formation's highest conductive horizon. Since the hydraulic pulse interference test, utilizing pre and post test data is a high precision transient test, even minor impediments to flow by the PRB can be quantified.

