



## Powerwave Odyssey Custom Stimulation Frequently Asked Questions

**Question 1:** Which types of wells are typically stimulated using the Powerwave Odyssey tool; producers, water injectors, disposal wells, horizontal, vertical, deviated, onshore or offshore and how is it deployed?

**Answer 1:** All well types in need stimulation are candidates for Powerwave. Powerwave provides for pin-point injection and deeper penetration along the entire length of the completed interval. The Powerwave Odyssey tool is typically run on jointed pipe or coiled tubing.

**Question 2:** Is there any special modeling or pre-programming associated with Powerwave Odyssey stimulation?

**Answer 2:** Unique to the oil and gas industry, Wavefront provides stimulation modeling for the purpose of comparison between Powerwave pulsing efficiency and steady-state conventional injection. Out of the modeling flows a precise stimulation program designed to achieve maximum distribution and depth of penetration.

**Question 3:** What are the typical flow rates associated with the Powerwave Odyssey tool?

**Answer 3:** For a 1-11/16" 1,200 psi Powerwave Odyssey tool the flow rate ranges from 0.8 to 2.8 barrels per minute. Additional, lower pressure ranges and flow rates are also available from Wavefront.

**Question 4:** What is the typical depth of reservoirs?

**Answer 4:** Powerwave tool operation is not depth dependent. As long as the tool can be deployed on coil tubing or jointed pipe stimulation can be performed.

**Question 5:** Is a Powerwave stimulation better suited for heavy oil or light/medium oils?

**Answer 5:** Powerwave stimulation candidate selection is independent of oil quality. The strength of Powerwave is the ability to optimize the efficiency of the stimulation by effectively placing fluids across the entire stimulation interval.

**Question 6:** What is the typical radius of influence achieved by the Powerwave Odyssey tool?

**Answer 6:** Radius of influence is related to volume of stimulation fluid used, thickness of a zone, and the time spent at a given location in the completed interval. Based on past modeling case histories the radius of influence can be  $\geq 3$  feet. Based on a historical measured case history the radius of influence was  $\geq 2$  feet (2 feet being the maximum depth capable of being measured by the device detecting the radio-active tracers).

**Question 7:** Are there any concerns on the incompatibility of the Powerwave Odyssey tool to acids, co-solvents, etc., and are there any HSE concerns?

**Answer 7:** All Powerwave tools are designed to be H<sub>2</sub>S, acid, mutual solvent, and overall corrosion resistant. There are no related HSE concerns related to the field use of the Powerwave Odyssey.

**Question 8:** What are the financial benefits of Powerwave Odyssey stimulation over other approaches?

**Answer 8:** Financial benefits include: (1) the elimination or vastly reduced volumes of chemicals such as fluid diverters, emulsified acids, fluid spacers, etc. By eliminating or reducing unnecessary volumes of chemicals there is significant cost savings; (2) greater post-stimulation sustainability – time between stimulations may be increased thereby reducing on-going stimulation costs; and, (3) Better overall post-stimulation performance (more oil or more water injection) as more of the reservoir is contacted by the treatment chemical.