

Practical Injection Procedure: BOS 200®

Product Handling

BOS 200® is stored and delivered in 25 kg bags. The product is a blend of activated carbon powder and nutrients. For BOS 200® treatments, additional bacteria must be added. A special blend of bacteria (Trap & Treat® Bacteria Concentrate) is delivered in along with the BOS 200® product in 20 litre buckets.

The dry BOS 200® powder is transferred to the mixing unit using an injector pump. This minimises the dust exposure and physical heavy lifting for the operator.

Batch mixing and preparation

The density and volume of BOS 200® required for each injection point is determined by the Project Remedial Design Description (PRDD), and according to this plan the calculated ratio of water, bacteria culture, and BOS 200® is transferred to the injection system mixing tank. The injection system has a maximum BOS 200® density capacity of 400 g/l. If the PRDD density for an injection point exceeds this limit, a second injection event must be considered.

In cases with larger zones of free phase contaminant, additional gypsum nutrients are added to the slurry mixture to maintain the sulphate-reducing degradation process in the subsurface for a longer period of time.

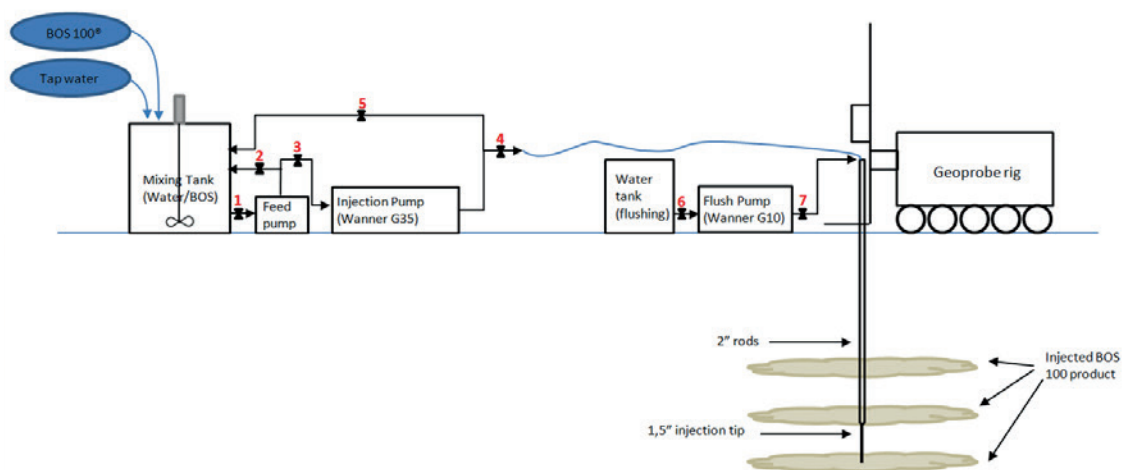


Figure 1 Schematic diagram of the injection system, drill rig, and subsurface.

Injection system

The blended BOS 200® product is pumped in a closed system from the mixing tank to the injection tip. This minimises the potential for leakages and uncontrolled distribution in the subsurface.

The injection system consists of a mixing unit and a pumping unit. In the mixing unit the calculated ratio of water, bacteria culture, and BOS 200® is prepared in a slurry. The pumping unit is divided into a feed pump and a high pressure injection pump. The feed pump supports the injection pump and recirculates surplus product back into the mixing tank. This recirculation assists the mechanical stirring

in the mixing tank and helps keep the BOS 200® product in suspension. This recirculation is controlled by valves 2 and 3 in Figure 1.

The injection pump (Wanner G35 High Pressure Pump) runs continuously to maintain a high pressure and instantaneously overcome any back pressure in the subsurface. The injection process is manually operated by opening and closing valves 4 and 5 (Figure 1). The volume of BOS 200® product injected into the subsurface is controlled by monitoring the water level drop in the mixing tank. The pump outlet pressure and the subsurface back pressure can be monitored at the control panel.

When an injection point has been completed, the vertical section of the injection rods from the ground surface to the injection top is flushed with water to prevent the BOS 200® grains clogging the injection tip.

All data is recorded manually in the field notes, along with injection depth volumes, product density, injection point number, and injection depths.

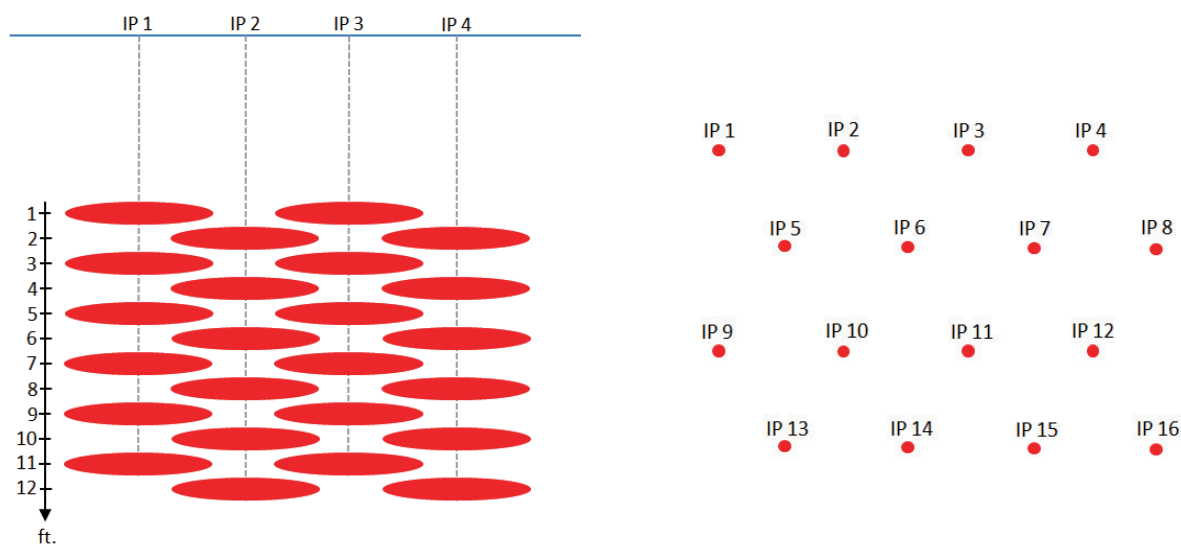


Figure 2 Vertical distribution and offset of injection levels (left) and horizontal triangular pattern of injection points (right).

Subsurface injections

Full distribution of BOS 200® in the subsurface is ensured by designing the injection points in a horizontal triangular pattern, and with vertical offset injection depths. The hydraulic properties of the subsurface formation, and the required BOS 200® density and volume determines the distance between the injections points in the horizontal triangular pattern, but is typically between 1.5-5.0 metres (Figure 2). The triangular pattern optimises the horizontal product distribution compared to a traditional square injection grid. To further optimise the product distribution in the subsurface, the injection depths are offset 0.3 metres relative to neighbouring injection points, as illustrated in Figure 2.

All injection points are sealed with bentonite following injection completion.