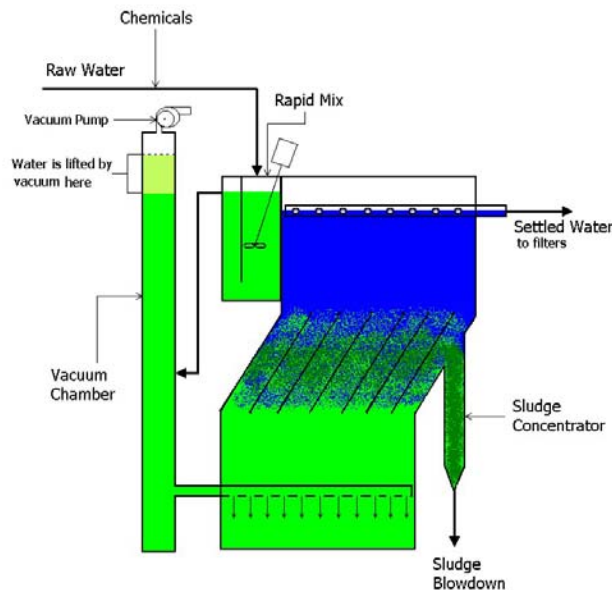


SUPERPULSATOR TECHNOLOGY

Superpulsator clarifiers are upflow flocculation/clarification units that combine sludge-blanket flocculation with inclined-plate settling. Superpulsator reactor is a product of ONDEO Degremont Inc. (ODI).

Figure 1 is a schematic of the Superpulsator reactor. Chemically dosed raw water enters a high-rate flocculation tank that provides a detention time of approximately 3 minutes. From this tank, the water flows by gravity to a sealed vacuum chamber that discharges the water to laterals at the bottom of the reactor. A vacuum pump is used to create a vacuum within the vacuum chamber. The vacuum causes the water level in the chamber to rise to a predetermined height (approximately 16 inches). A timer actuates an inlet valve on the chamber to open quickly, so the water stored in the chamber drains rapidly (at a higher velocity) into the bottom of the distribution system, after which the chamber is refilled. This discharge creates a pulsation action and expansion of the sludge blanket in the reactor. As the water moves upward in the reactor, it starts to flocculate in the presence of the already formed sludge blanket. Above the sludge blanket, a system of parallel plates inclined at 60 degrees to the horizontal enhances the clarification process. The upper level of the sludge blanket is controlled by overflow into a sludge concentrator where the excess sludge is thickened before being discharged by intermittent automatic withdraws. Above the inclined plates, the clarified water is collected through a set of submerged orifice laterals.



Superpulsator Flow Schematic

Figure 1

Superpulsator reactors can be efficiently operated at hydraulic upflow rates up to 4 gpm/sf.

Superpulsator reactors provide excellent performance over a wide range of raw-water quality conditions. Superpulsators prove to be extremely effective for the treatment of river water similar to the raw water of Steubenville. The reactors combine flocculation and coagulation in a single tank eliminating the need for separate flocculation basins. Also, no additional sludge collection and sludge removal facilities are required. The process does not significantly rely on mechanical equipment (other than a vacuum pump). Superpulsators are very forgiving reactors and can provide satisfactory performance over prolonged time periods without optimal chemical dosing and/or with the vacuum pump out-of-service (i.e., without pulsations). The process produces the most concentrated sludge (i.e., the least sludge volume) among the clarifier types that the City examined.

Superpulsators exhibit less site area requirements than Lamella settlers, but slightly higher than the Actiflo system.

Essential for the reactor performance is the maintenance, beneath the clarification zone, of a sludge blanket that enhances flocculation. A sludge blanket can be maintained easily when the units are used to treat river water. However, it is more difficult to maintain a sludge blanket under extremely low raw-water turbidities (at turbidity levels significantly lower than those experienced at Steubenville). This was the conclusion of a survey conducted among Montgomery Watson Harza's project managers who are familiar with this type of reactors. All managers agreed that Superpulsators excel in the treatment of river water.

The advantages and disadvantages of the Superpulsator reactors are:

Advantages	Disadvantages
High solids removal efficiencies for a wide range of raw water quality conditions	Operation must be seasonally adjusted to the raw water conditions
Extremely effective for river water treatment	Operator training is required
Small site area requirements	Maintenance of a proper sludge blanket is required
Good flocculation without additional mechanical mixing	Addition of a polymer is required to maintain and appropriate sludge blanket
Flocculation and clarification are performed in the same unit	Building up a sludge blanket is required during start-up
Operation can be automated	A vacuum pump is required
Minimal short-circuiting	
No mechanical sludge collection and sludge removal is required	
Least costly	