

Floating Horizontal Aerators Enhance Eufaula, Alabama Activated Sludge Plant



The Eufaula, Alabama, wastewater treatment plant (WWTP) is an extended aeration activated sludge facility designed for an average daily flow rate of 2.7 million gallons per day (mgd). Prior to February, 2005 this WWTP used vertical aerators to provide oxygen and mixing in its aeration basins. The plant has two aeration basins, each 1.87 million gallons in volume, which had 160 horsepower (hp) of vertical aerators in each basin. This facility was having difficulty maintaining adequate dissolved oxygen (DO) levels, with mixed liquor DO concentrations often in the range of 0.3 to 1.0 mg/L. The low DO levels sometimes caused filamentous bulking problems, and there were accumulations of sludge on the basin bottoms because of inadequate mixing. In addition, the plant was spending about \$90,000 per annum on power costs. Moreover, the vertical aerators required significant maintenance to keep them in good operating condition.

Because of the problems noted above, the staff at the Eufaula WWTP began to evaluate options to improve WWTP performance via changes in the aeration system. One option was to replace the existing aerators with other vertical aerators. A second option was to replace the existing aerators with a diffused aeration system. A third option was to install floating brush rotors manufactured by S&N AIROFLO of Greenwood, Mississippi.

Because of past problems with vertical aerators, WWTP staff was not inclined to install new vertical aeration units. Although diffused aeration is widely used in activated sludge processes, the staff decided not to use diffused aeration because of high capital cost. Instead, the decision was made to install floating brush rotors.

BACKGROUND ON FLOATING BRUSH ROTORS

Until the last few years, aeration of activated sludge was typically achieved by diffused aeration systems or vertical aerators. Also, fixed brush rotor aerators were usually used in oxidation ditches. These aeration systems have generally performed well and provided adequate oxygen transfer and mixing. Since 1998, floating brush rotors (FBRs) have become popular choices for oxidation ditches and other types of activated sludge facilities.

Because of the above problems with original fixed rotor designs, floating horizontal aerators

have become popular when existing units need to be replaced. FBRs have a very high oxygen transfer rate. FBRs are set at their optimum operating depth to provide maximum oxygen transfer regardless of the water level in the aeration basin. In addition, FBRs provide excellent mixing of the mixed liquor. The Floating Brush Rotors manufactured by S&N AIROFLO of Greenwood, Mississippi, have high pumping rates of about 2100 gpm per horsepower.

PERFORMANCE AT THE EUFAULA, ALABAMA WWTP

The Eufaula, Alabama Wastewater Treatment Plant (WWTP) is designed to treat 2.7 mgd of medium strength municipal wastewater. Current flow rates at the plant are 1.7 mgd (average daily) and 2.7 mgd (peak daily). Influent BOD₅ and suspended solids (TSS) concentrations are



about 150 mg/L and 180 mg/L, respectively. Each aeration basin is approximately 178 feet long, 158 feet wide, and 12 feet deep, with 2:1 side slopes. In February, 2005 the 160 hp vertical aerators in each basin were replaced by six 20-horsepower S&N AIROFLO rotors. Consequently, aeration horsepower was reduced by 25 percent.

NPDES permit requirements for the effluent are 25 mg/L for BOD₅ and 30 mg/L for TSS. Presently, there are no limits on ammonia-N, total Nitrogen, or total phosphorus. Typical effluent concentrations for BOD₅ and TSS are in the range of 2 to 5 mg/L and 5 to 15 mg/L, respectively. Even though nitrification is not required, the final effluent ammonia-N levels are usually <0.1 to 0.2 mg/L. The aeration basins are normally operated at about 3500 mg/L mixed liquor suspended solids (MLSS). Thirty minute sludge settle ability typically is in the range of 200 to 400 ml/L with sludge volume index (SVI) of 60 to 120 ml/g. Sludge age is usually maintained in the range of 20 to 25 days. As stated above, DO concentrations in the mixed liquor often were in the range of 0.3 to 1.0 mg/L when the vertical aerators were in use. With the S&N

rotors, DO levels are now in the range of 2 to 4 mg/L throughout each aeration basin.

Common design practice for vertical aerators calls for 80 to 135 hp per million gallons of aeration basin volume to provide adequate mixing in activated sludge reactors. With S&N rotors, 60 to 80 hp per million gallons usually is adequate to provide excellent mixing. It is generally recognized that Floating Brush Rotors provide better mixing because they maintain horizontal velocities in the mixed liquor. Horizontal movement of the water helps keep biomass in suspension and promotes intimate contact of wastewater organics and nutrients with the biomass. The Eufaula WWTP aeration basins were plagued with the problem of biomass settling in some parts of the aeration basins, creating sludge zones at the bottom of the basins. For efficient biological metabolism to occur, it is essential that the biomass be maintained in suspension. If the biomass settles in the aeration basins, sludge settle ability problems and poor effluent quality may occur. Since the S&N AIROFLO rotors were installed, the Eufaula WWTP aeration basins have mixing throughout the basins with no bottom sludge accumulations.

Another significant advantage of S&N AIROFLO FBR's is energy savings. Since installation of the S&N aerators, the Eufaula WWTP has experienced average monthly savings in power costs of \$3500. This amounts to a 48% reduction in power costs to this treatment facility. In addition, the S&N FBR's require much less maintenance than the vertical aerators previously used.

In summary, the Eufaula WWTP operations and maintenance staff has been highly pleased with the S&N rotors. Activated sludge process performance has been improved; mixing of the mixed liquor is substantially better; oxygen transfer rates are much higher than before; NPDES effluent requirements are satisfied with significant room to spare; and O&M problems have been reduced. The Eufaula WWTP staff just wishes they had made the switch from vertical aerators to Floating Brush Rotors sooner.

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