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Let's Solve Water

Case study
Treatment • Top-entry agitators

Top-entry agitators keep costs low

Saint Petersburg – reducing the impact of 2.2 million people

New aeration basins are treating 1.5 million m³ of wastewater per day to reduce emissions of phosphorous and nitrogen. Flygt agitators have been chosen because of their ability to keep entire basin volumes in motion, despite their low energy footprint.

The Baltic Sea, the largest body of low-salinity water in the world, has a coastline shared by nine countries. As the drainage basin to 85 million people, the environmental strain on the sea has been considerable for many years.

Saint Petersburg, the former capital of Russia, on the eastern reaches of the sea, has a population of five million. To reduce the environmental pressure on the Baltic, a multilateral initiative aims to reduce levels of phosphorous and nitrogen by deep biogenic removal from the treated discharge.

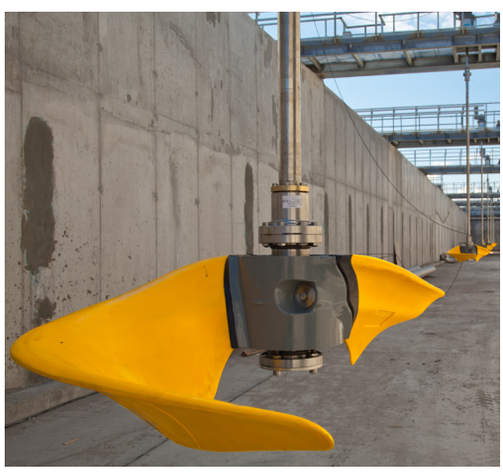
Treating 1,500,000 m³ per day

An important stage in meeting the more stringent requirements has focused on the Central Wastewater Treatment Plant, situated just five kilometers from the historic heart of Saint Petersburg. The facility services 2.2 million of the city's inhabitants, processing 1.5 million m³ per day.

> "By optimizing thrust and bulk flow, the agitators consume just 1-2 watts per cubic meter."

The plant has six pairs of primary and secondary basins for mechanical treatment, and 12 aeration basins for biological treatment. Wastewater enters the inlet chamber, continues through the main pump station and proceeds to mechanical, biological and chemical treatment processes.

Per Selenius, Product Manager, Water Solutions at Xylem explains: "the agitators, installed in aeration basins, have three specific roles: one, to maintain uniform concentration of the biomass and substrate in the reactor volume; two, to prevent sludge sedimentation in the aeration basins; and three, to check the formation of floating sludge."



The banana blades help keep the bottom free from sediment and the surface free from floating sludge.

Product details

Agitator type:	SY4850
Motor rating:	2.2 kW
Power consumption:	1-2 watts per m³
Population served:	2.2 million
Volume treated:	1.5 million m³ per day

Process principle:
reduce levels of phosphorous and nitrogen by deep biogenic removal.

Forty-four top-entry agitators
The agitators, 44 in all, are installed in the pre-denitrification, anaerobic, anoxic and gas removal zones. The SY4850 units have a rated motor rating of 2.2 kW and are equipped with the Flygt self-cleaning banana blades.

The plant is operated by SUE Vodokanal of Saint Petersburg, which set a number of criteria that needed to be met by the winning tender including:
– suspension of both top and bottom sludge
– low energy consumption
– high operational reliability.

With experience from over 200,000 mixer installations around the world, and over 50 years of experience designing and commissioning mixer applications, Xylem was well placed to meet these criteria.

Solids suspension
"One of the reasons Xylem won the competitively-fought tender was because we could demonstrate the ability not only to keep the bottom free from sediment, but also to create sufficient flow to prevent the buildup of floating sludge," says Karl Tawaststjerna, Technical Director at Petroplan, a Xylem distributor in Russia, which also supplied engineering consultancy for this project.

With over half a century of mixing experience and hands-on knowledge of various applications it was Xylem that pioneered the use of thrust as the main performance parameter, now established by the ISO 21630:2007 standard. Today, Xylem meticulously engineers each installation to capitalize on the tank's natural hydraulic characteristics.

"To ensure that the entire volume of a basin is kept moving you need to create sufficient thrust," says Karl. "With the help of tools such as Computational Fluid Dynamics, we were able to determine the right technology, mixer size and layout while minimizing power consumption."

Low energy consumption – 1-2 watts per m³
National legislation stipulates the use of energy efficient equipment in water treatment facilities. Even though the agitators are in operation 24/7, the overall power consumption is extremely low. The agitators themselves have an installed power rating of just 2.2 kW and have a very low rotational speed of 30 rpm or less.

The self-cleaning characteristics of the banana blades also help account for the low power consumption, since they reduce the amount of fibers and rags that can get caught on the propellers – this results in sustained energy efficiency over time.

"All the hard work paid off in the end," says Per. "By optimizing thrust and bulk flow, the agitators consume just 1-2 watts per cubic meter, while generating sufficient flow in the basins. In other words, we have delivered the maximum bulk flow for the minimum of power input."

High operational reliability – 100,000 hours operational lifetime
The construction of the agitators is very robust with an operational lifetime of over 100,000 hours. High-quality materials have been used throughout: the shaft, for example, is made from high alloy steel.

But perhaps most important of all is the gearbox's high service factor: "With Flygt top-entry agitators, we have, as standard, a cast-iron bearing housing positioned beneath the gearbox," Per explains. "This is because its allows the bearings to take most of the radial forces created by the propeller. We prefer this arrangement because bearings are less sensitive than gearboxes, and of course less expensive to replace."

As the fight to preserve the Baltic continues, Flygt aerators are helping Saint Petersburg reduce emissions of phosphorous and nitrogen, while keeping associated energy costs down to the minimum.

1590 . Top-entry agitators keep costs low . 1 . Master . 1 . 20121204

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