KNIGHT
MATERIAL TECHNOLOGIES

CASE STUDY

Structured Media Replaces Monolithic Blocks to Solve RTO Clogs for Wastewater Treatment Plant

Background

Buckman Water Reclamation Facility (WRF) is JEA's largest wastewater treatment facility, with a permitted annual average daily flow treatment capacity of approximately 52.5 million gallons per day. Buckman Regional Residuals Biosolids Treatment Facility in Jacksonville, Florida, is owned by JEA (formerly Jacksonville Electric Authority).

As a publicly owned utility, JEA serves hundreds of thousands of residents in the area. The Buckman Water Reclamation Facility treats more than 22 million gallons per day (MGD) in its activated sludge process. A biosolids facility processes solids from this and four other JEA facilities in three anaerobic digesters to produce fertilizer.

In the initial phase, the digested biosolids must have moisture removed in a dryer. A regenerative thermal oxidizer (RTO) processes waste gas from the dryers used at the wastewater treatment (WWT) facility.

Situation

Buckman technicians found that the monolithic ceramic block media within the RTO frequently clogged with silica powder, a byproduct of siloxane found in wastewater.

Organic particulates aren't a clogging issue because they can be disposed of using the bake-out feature in an RTO. This process carbonizes the organic particulates at elevated temperatures, causing them to detach from the ceramic media and subsequently carried out with the stack exhaust gas.

Inorganic particulates, such as the silica found here, respond differently. When silicon-laden fumes pass through the ceramic media bed at temperatures greater than 1300° F, the silicon atoms in the silicone combine with oxygen to form silica fume. Because this is the same material used in a variety of ceramic coatings, the natural tendency is for the silica fume to adhere to the ceramic media. As it builds up over time, it reduces the void space in the media and increases the pressure drop of the process gas through the RTO.

Void space within a monolith block is confined to narrow vertical channels that run parallel to each other over the entirety of the block. These channels are often a scant quarter inch in width, and as the void space decreases, the channels plug up. As a result, the RTO could not effectively handle the waste gases from the dryer, reducing its effectiveness in burning off air pollutants and odors while also requiring frequent cleanouts.

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Challenge: Previous Tower Saw Decades of Service

The global siloxane market, driven mainly by its increased use in personal care products, has exhibited an upward trajectory during the past several years, with a forecasted CAGR (Compound Annual Growth Rate) of 5.5% through 2028. The siloxanes from skincare and haircare products pass into the wastewater treated at the biosolids facility.

There, the RTO handles the waste gas coming from the dryer to burn off air pollutants and odors—and as such, treats waste gas laden with silica oxides, clogging the channels of the monolithic blocks within the RTO. This reduces the system's efficiency, burns more energy to compensate for the blocked ceramic media, and requires excessive downtime to remove the silica clogging the channels in the blocks.

The operators at Buckman turned to Knight Materials Technology for a solution due to its reputation for specializing in environmental heat transfer equipment, mainly for handling corrosive or inorganic materials.

Solution: FLEXERAMIC® Type 28 Structured Packing from Knight Material Technologies

Knight Materials replaced the traditional monolith blocks in one of the three cells within the RTO with FLEXERAMIC® Type 28 structured packing, which feature a proprietary geometric pattern comprising vertically aligned corrugated ceramic sheets with more airflow and surface area greater than monolithic design.

JEA operators conducted a six-month test, running the unit with both blocks to evaluate the difference between the two types of structured packing. The FLEXERAMIC Type 28 structured packing provided greater airflow (throughput) and required less frequent cleaning. After examining the results, the JEA replaced the packing in the remaining two cells within the tower with FLEXERAMIC structured packing and reduced cleaning cycles from every three weeks to every four months.

The facility also reduced its gas usage due to increased energy. This combination of labor and energy savings adds up to a significant return on investment during the tower's anticipated lifespan, which stands at twenty years and counting.

For this tower, the company utilized:

- FLEXERAMIC® structured media packing blocks

End Result: Years of Trouble-Free Service

Whether planning a retrofit, upgrade, or new construction project, FLEXERAMIC structured packing from Knight Material Technologies is the only packing media that demands minimal maintenance, enhances energy efficiencies, and delivers reliable performance for decades.

The superior performance of FLEXERAMIC structured packing provides enhanced controlled odor or emissions of volatile organic compounds (VOCs) to improve air quality and comply with local or federal environmental regulations.

Looking for your own "set it and forget it" RTO construction or retrofit?
Call Knight Material Technologies for your next tower design.