

# Davyhulme WwTW

## Biostyr® BAFF plant refurbishment

by Ian Stapleton

United Utilities is the second largest water and sewerage company in England and Wales, and Davyhulme WwTW is its largest wastewater treatment works, treating a flow rate of up to 785ML/d and serving a population equivalent of 1.5 million. Davyhulme WwTW is located in the Urmston area of Manchester, adjacent to the historic Manchester Ship Canal and within a stone's throw of the Trafford Centre. The existing Biostyr® plant at Davyhulme was commissioned in 1998 following a two year construction programme, which was itself preceded by an extensive period of pilot trials to demonstrate the capability of the process for tertiary ammonia removal in order to meet the stringent ammonia discharge standards which were required.



### Process description

The Biostyr® process is a biological aerated flooded-filter (BAFF) system which is extremely compact and was, therefore, able to fit into the limited land area which was available at Davyhulme.

The effluent to be treated flows upwards through a fine granular media, known as Biostyrene®, which is retained by a slab which contains a large number of regularly spaced nozzles through which the effluent passes whilst retaining the media below. A film of aerobic biomass (similar to that found in a conventional activated sludge process) forms on the media and the bacteria present break down the pollutants into cellular material which is retained within the media bed. The Biostyrene® media also simultaneously acts as a filter to remove solid particles.

Air is injected into the base of each cell through an aeration grid to provide a source of oxygen for the biomass and to provide the necessary environment for nitrification to occur.

Each cell is periodically backwashed to remove trapped solids and excess biological growth utilising a head of treated effluent that is stored above each cell. This method eliminates the need for a separate clean backwash water storage tank and pumping equipment such as are required by other BAFF plant designs.

The Davyhulme Biostyr® BAFF plant is one of the biggest of its kind in Europe and comprises 36 (No.) filter cells, each providing a total filter surface area of 113m² equating to a total filter area for the plant of 4,068m².



### Davyhulme Biostyr refurbishment

The primary driver for the Biostyr® refurbishment project is to ensure that a 3mg/l ammonia consent can be maintained following the introduction of centrate from a new plant comprising thermal hydrolysis of sludge prior to mesophilic anaerobic digestion which forms part of the United Utilities' Sludge Balanced Asset Programme (SBAP).

The centrate from this plant is particularly high in ammonia so, in order to achieve an overall discharge concentration of 3mg/l, the Biostyr® plant must have the capability to achieve a 1mg/l ammonia effluent consent standard for its proportion of the WwTW flows.

Since its introduction in the early 1990s the Veolia Biostyr® design has been subject to a number of enhancements in order to improve the performance and mechanical durability of the plant. These design improvements have been proven on subsequent Biostyr® installations and part of the refurbishment programme is to implement these improvements at Davyhulme. This will allow the plant to operate with the increased process load whilst meeting and maintaining its consent parameters.

### Undertakings

In addition to the implementation of design enhancements which Veolia is undertaking, United Utilities in-house Asset Optimisation Team will also be carrying out work to optimise the control aspects of the plant. This involves replacement of some instrumentation, calibration of existing instrumentation and modifications to the software control system.

The overall refurbishment work programme is being overseen by UU's principal contractor GCA JV (Galliford Costain Atkins) which is one of United Utilities' AMP5 capital delivery partners. The refurbishment project has been running since the beginning of 2012 and is projected to complete in February 2015. The long programme is necessitated by the requirement that the plant must be kept in operation at all times, so that only a single pair of cells can be taken out of service at any one time for the work to be performed.

GCA also oversees and manages the sub-contracted cell refurbishment works whilst the plant remains in service. This is done in conjunction with United Utilities Operations personnel and involves: cell isolation, cell draining, installation of safe methods of access and egress, and returning the cells back into service.

### Functionality and condition surveys

Part of the refurbishment project also includes the undertaking of a number of functionality and condition surveys which include core sampling to ascertain concrete condition and measurement of media depth to establish how much additional Biostyrene® media is required to re-establish the original media levels. In addition to new media, some of the media which has been lost over the years

will also be recovered from the backwash tank. Additional tasks include:

- Replacement of the media retaining mesh and anti-foam netting.
- Renewal of some 108 (No.) valves in total.

Veolia Water Solutions and Technologies (VWS) element of refurbishment comprises replacing approximately (No.) 4,000 air grid brackets as well as the procurement, delivery and off-loading of approximately 1,200m<sup>3</sup> of additional Biostyrene® media to top up cells that have lost media over their 15 years of operation.

Also, at the request of United Utilities, all of the existing polypropylene nozzles (i.e. approximately 200,000 in total) will be replaced even though the majority of the units are still in a serviceable condition.

The Biostyrene® media is being delivered in curtain-sided trucks, each of which contains approximately 75m<sup>3</sup> of the material. A pair of temporary silos, each of approximately 50m<sup>3</sup> capacity (constructed from scaffold tubing and textile material) is used to provide buffer storage for the delivery volumes of media prior to being transferred to a pair of loading silos of similar design but only 12m<sup>3</sup> capacity. The delivery vehicle and silos are connected together using solid and flexible pipes to enable the media to be 'blown' from the truck to the temporary storage facilities and from there into the designated cell within the Biostyr® plant.

### Environmental considerations

An important element in the scheme is the requirement to minimise the environmental impact of the waste generated by recycling the polypropylene nozzles which had been removed. The recycling element proved to be less straight forward than anticipated due to the varied levels of soiling adhering to the nozzles which had been removed. This dictated that they needed to be cleaned prior to processing and this additional requirement limited the recycling facilities which were prepared to take the nozzles.

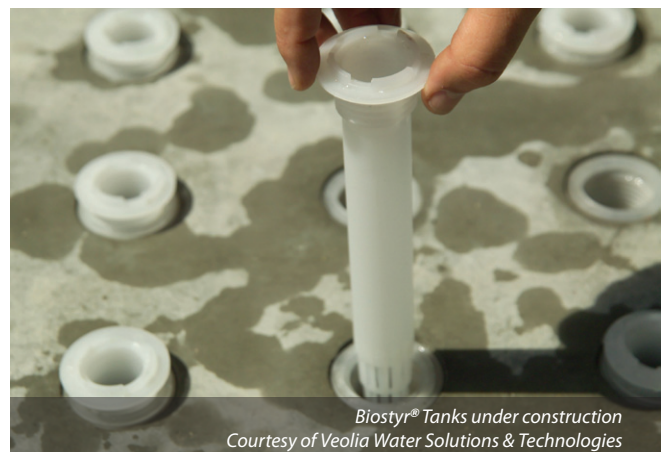
Through a determined effort by all parties, Veolia Environmental Services successfully located a recycling outlet which has, to date, processed around 45,000 (No.) nozzles. By the end of the project, approximately 150m<sup>3</sup> of material will have been sent for recycling - a significant environmental positive when compared to the alternative option of sending this volume of plastic to landfill.

Once the Biostyr® refurbishment at Davyhulme WwTW is completed it will remain in service for many years to come in addition to the 15 years of service which it has already provided.

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