Cog Moors WwTW

an innovative use of UV technology to achieve Bathing Water compliance

by
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The Cog Moors Wastewater Treatment Works (WwTW) is located to the West of Cardiff in the Barry catchment and is an activated sludge plant serving a 208,000PE across a large geographical catchment including the West of Cardiff. In order to meet compliance with the directive and as key part of the overall catchment solution the first UV plant in the UK designed to treat storm flows has been installed and commissioned at the works before the 2009 bathing season. The innovative use of this technology has resulted in significant whole life costs and sustainability savings over the traditional approach.

The 3 (no.) UV 4000 treatment banks installed *Courtesy of Dwr Cymru Welsh Water*

Cog Moors WwTW Storm UV Treatment

The treatment works is consented for a FFT of 2.145m^3/s with a 50 mg/l (95%ile) BOD consent. It comprises an inlet works with flows subjected to two dimensional 6mm equivalent screening and storm overflow via 10 no rectangular storage settlement tanks (total 16800m^3). The flows discharged from the storm tanks gravitate to the combined final effluent (FE)/storm pumping station. The flow to treatment then passes through grit removal and then to the primary settlement stage. The settled sewage is then pumped forward to the secondary treatment process which comprises an activated sludge plant followed by final settlement. The treated Effluent then gravitates to the combined Final Effluent / Storm pumping station where it is discharged to sea via a long sea outfall.

The storm UV plant at Cog Moors is designed to treat all storm flows up to 2.38m^3/s that are discharged after the filling of the storm tanks during the bathing season. The storm flows then gravitate from the discharge weirs at the end of the storm tanks and flows are diverted into the UV plant, by breaking into the existing storm return flume, before returning flows downstream where it continues to the pumping station for discharge via the long sea outfall.

The Team

As part of the Dwr Cymru Asset Management Alliance (AMA) the South East Team (SET) which comprises of Dwr Cymru Welsh Water and its strategic construction partners, Imtech Process Ltd and Morgan Est together with cost consultants Chandler KBS and EC Harris are responsible for the design and construction of a £190 million investment programme to resolve unsatisfactory combined sewer overflows (uCSO's), key flooding and growth issues during Asset Management Plan 4 (AMP4) during the period 2005-2010. As part of the Amp 4 delivery, under the Bathing Water directive, there are drivers on compliance at the EU designated bathing waters at Barry (Jackson Bay, Whitmore Bay and Cold Knap).

The UV 4000 medium pressure lamps *Courtesy of Dwr Cymru Welsh Water*

- A new dual supply 11kV/400v sub-station installed adjacent to the treatment plant and fed from the existing site 11kV switchgear plant.
- A central MCC (motor control centre) installed within a kiosk is used to automate and control the UV treatment plant and associated storm facilities.
- The main UV structure that houses the UV treatment units which comprises of three Trojan UV4000 systems comprising 5 modules each equipped with 22 lamps. One unit will be installed in each of the channels and they operate in a duty 1/duty 2/standby configuration.
- A new chamber built onto the inlet of the existing storm flume structure will redirect storm flows to the UV chamber via an 1800 NB concrete pipeline.
- The outlet channel from the UV structure is connected to a new connection chamber via a 1500 NB concrete pipeline. The pipeline is installed with a 1500 NB mag flowmeter to measure the storm flows.

The storm UV system is the first commercially successful, medium-pressure UV lamp system that is specifically designed for handling high volume and low quality wastewater and incorporates an automatic chemical / mechanical cleaning technology.

Carbon Footprint and Economic Analysis

The use of UV disinfection on continuous discharges has resulted in a perception that all UV disinfection systems consume large amounts of energy and therefore, have high associated operating costs and are not 'green'. They were also considered difficult to maintain and operate. However these perceptions are not necessarily applicable when using UV to disinfect intermittent discharges. In order to deal with these perceptions a Carbon Footprint and Economic analysis comparison of storm water treatment options at Cog Moors WWTW was carried out.

In Table 1 below it can be seen that in terms of CAPEX, annual OPEX, and net present value, the UV disinfection option is significantly lower in cost than the option to provide additional storm storage capacity.

The carbon footprint for the two options is shown in table 2 and includes greenhouse gas (GHG) emissions associated with construction as well as operation. The Storm UV as a Carbon footprint about a tenth of that of storm storage tanks over a 20 year period.

Costs	Process Option	
	Additional Storm Storage	UV treatment of storm spills
CAPEX	£8,473k	£2,900k
OPEX (per year) *1	£144k	£17k
NPV (20-year)	£7,477k	£3,210k
NPV (40-year)	£8,977k	£3,356k
NPV (60-year)	£9,271k	£3,318k

Table 1: Economic comparison of storm water storage against UV treatment at Cog Moors WWTW

It can therefore be seen that the storm UV treatment differentiates itself in terms of both economic analysis and carbon footprint.

Conclusions

The success of the use of UV technology to disinfect intermittent discharges is its use in developing the whole catchment solution. In the Barry catchment then no additional storage was required to be built in the catchment. This can directly be attributed to saving over £20m on the overall scheme against a prescriptive solution.

The use of UV on intermittent discharges has allowed a quantitative approach to the achievement of bathing water standards in the Barry catchment. It has led to the acceptance nationally by the Environment Agency of the UV treatment of storm discharges. The Generic consent for storm UV is being developed August 2008 and this will then form a national standard for these installations. As of June 2009 there are no contentious issues expected in agreeing the consent.

The application of this technology has been extended by Dwr Cymru to use in meeting the obligations under the Shellfish Directive.

The new Water Framework Directive when implemented in AMP5/6 will give additional obligations on the water companies. The proving of this technology will give an additional option for the treatment of storm water discharges.

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Source of Emissions	Process Option	
	Additional Storm Storage 25,000m^3	UV treatment of storm spills
Emissions associated with concrete for tanks/channels	8463	94
Emissions for non-concrete aspects of construction	4231	47
Emissions for operation over 20 years	155	1253
Emissions for treatment of additional returned storm water over 20 years	11	N/A
Estimate of total embodied CO_2 over 20 years (tonnes)	12,860	1,394

Table 2: Carbon Footprint for Storm Storage and UV Disinfection Options