

TOWARDS ZERO IMPACT SEWAGE TREATMENT SYSTEMS - AN INTEGRATED APPROACH

Steve Churchouse, Project Manager, Wessex Water Services Ltd, Grosvenor House, The Square, Lower Bristol Road, Bath, BA2 3EZ, United Kingdom.

Abstract

Wessex Water, one of the 10 larger water and sewerage utilities in the UK, has taken an integrated approach to sewage treatment and considers the aim of low environmental impact sewage treatment a realistic long-term goal. Towards this aim Wessex Water has implemented a number of innovative schemes to help provide a level of treatment significantly above the minimum required by current legislation. Our stated policy is to introduce cost effective processes to achieve a disinfected effluent for all our coastal recreational water sites. Examples will be presented of Wessex Water's approach to sewage treatment at coastal sites discharging into the Bristol Channel and the English south coast.

Introduction

Wessex Water's approach to minimising environmental impact of its water and sewerage treatment works can be illustrated with reference to the route taken to tackle three different environmental problems. These are, sludge management and disposal for a major city (Bristol), a large community sewage discharge into an environmentally sensitive harbour area (Poole), and treatment sewage for a small community in a national park area with an adjacent bathing beach (Porlock).

Sludge Management and Disposal in the Bristol Region

With a regional population of 2.5 million customers and an annual wet sludge production of approximately 1 million tonnes, Wessex Water has a substantial quantity of sludge to dispose of. Of this sludge some 70% can be disposed to land, leaving some 30% of the annual production from the Bristol/Bath area to be disposed of by other routes. In common with many other UK water companies, Wessex Water previously used licensed dumping at sea for most of the remaining 300,000 t/pa of sludge. Traditionally this had been dumped into a region of the Bristol Channel on the southwest coast of the UK, an area immediately adjacent to the seven estuary one of Europe's most important sites for wading and migratory birds.

In 1992 following an evaluation of alternative disposal options in terms of lifetime cost and environmental impact, Wessex Water became the first UK water company to install a thermal sludge drying process. This enabled us to halt sludge dumping at sea six years ahead of the 1998 EC directive deadline (EEC 91/271). The Swiss Combi thermal dryer at the Bristol Avonmouth works produces approximately 1-t/hr of a pasteurised granulated product with a significant commercial value as a soil conditioner (schematic operation Figure 1). The Biogran[®] granules produced by the process are a source of nitrogen, phosphorus and potassium and have found application in forestry, land

reclamation and agriculture. This allows return of valuable nutrients to the land, rather than the previous dumping into the Bristol Channel. The process has thus enabled Wessex Water to convert a potential problem into an economic environmental solution.

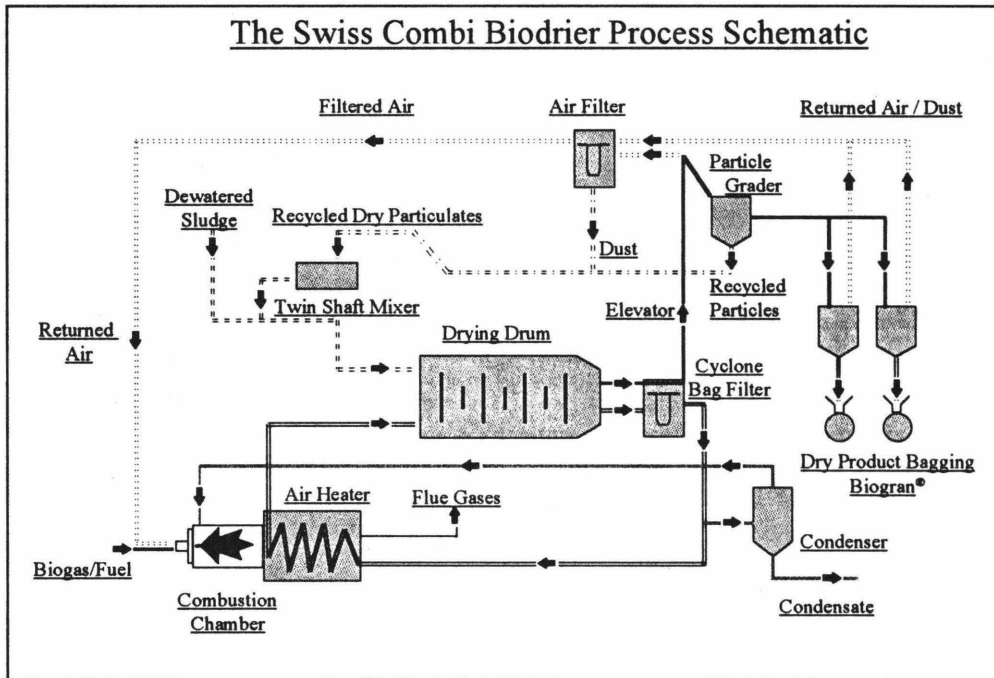


Figure 1: Schematic of operation of the Wessex Water Swiss Combi thermal drying process.

Large Community Sewage Discharge into a Harbour Area

In Poole on the south coast, we currently have the largest biological aerated filter sewage treatment system operating in Europe. This plant, with a capacity of 64000 m³/d is situated adjacent to a shopping precinct within an urban area and serves a population of 160,000 people. The plant discharges into Poole harbour a designated area of environmentally sensitive receiving waters. Poole harbour is a large shallow natural body of water almost entirely enclosed by land, thus making the area low natural dispersion for effluent discharge. The requirements of the site were therefore that the process should be compact, low odour and produce a fully nitrified high quality effluent. The plant has been operational since 1996 and has made a significant improvement to the effluent discharged into the harbour. During the period August 1996 to March 1997, average final effluent BOD values were 7.6 mgO₂/l with suspended solids of 10.2 mg/l and 1.0 mgN/l ammoniacal nitrogen.

Small Community Coastal Sewage Discharge in a National Park Area

For small to medium scale works Wessex Water has undertaken an evaluation of the Kubota membrane treatment system in cooperation with Welsh Water and South West Water. This process produces a fully disinfected effluent capable of meeting a 5 mg/l

BOD, 1 mg/l suspended solids and 1 mg/l ammoniacal nitrogen effluent consent (table 1). Following a review of the performance and economics of the Kubota process, a full-scale plant is being constructed for a 4000 population community at Porlock within Exmoor National Park. This process has also seen application in Japan at sites near Hiroshima on the Seto inland sea where similar requirements exist for the treatment of small volume effluent discharges into an important tourist and fishing region.

Analyte	Sewage Feed Average	Final Effluent Average	Minimum % Removal
Suspended solids / mg/l	224	< 1.0	> 99.3
Turbidity / NTU	>300	0.55	> 99.5
COD / mgO ₂ /l	538	< 24	>96
BOD / mgO ₂ /l	216	< 5	>98
NH ₃ /NH ₄ ⁺ / mgN/ (aeration tank dO ₂ maintained > 1 mg/l)	30	0.17	99.4
Faecal coliforms / 10 ⁶ /100 ml	24	< 0.000035	> 99.9998 (log 5.9)
Coliphage virus / PFU/ml	2000	< 1	> 99.9 (>log 3)

Table 1: Average Kubota pilot plant final effluent quality

Conclusions

By the introduction of advanced technology processes suitable for application well into the 21st century, Wessex Water has demonstrated how small and large scale works can be integrated with an effective sludge management strategy to minimise environmental impact. This approach allows increased recycling of nutrients and makes available high quality greywater without incurring excessive costs.