

# Otterbourne & Arundel Water Supply Works

## removal of cryptosporidium risk

by  
Richard Rumsey & Mark Bulpett

**S**outhern Water's Otterbourne Water Supply Works (WSW) is one of two key centres in Hampshire, supplying water to Southampton and Eastleigh and serving a population of approximately 180,000. The works comprises two sources, surface water and ground water. The company abstracts water from the River Itchen and provides conventional treatment of coagulation/flocculation with chemical dosing and clarification, rapid gravity filtration and disinfection. It abstracts groundwater from the chalk aquifer via five boreholes and a well/adit system. The only treatment provided was disinfection. The details of each source are summarised in the table below.



Arundel: Microfiltration membrane plant twist fish farm, cliffs & listed buildings

Photo: George Godden, courtesy: Southern Water.

Process Stream	Surface Water	Groundwater
Source	River Itchen	Well & adit system + 5 boreholes
Capacity	45MI/d	58 MI/d
Abstraction License	45MI/d	68 MI/d
Range	15 to 45MI/d	7 to 58MI/d

- \* installing a treatment plant for removal of cryptosporidium oocysts from the groundwater source (membrane plant).

### Membrane plant

A submerged membrane capable of continuously removing 1-micron particles, was selected as the preferred method of treatment. A pilot rig for the submerged membrane plant was installed to confirm key design parameters such as design membrane flux, backwash and chemical cleaning intervals.

### The new membrane plant comprises:

- \* seven primary submerged continuous microfiltration units, configured so that up to five units are in filtration, one unit in backwash and one unit in chemical clean-in-place (CIP);
- \* two secondary submerged continuous microfiltration units to maximise recovery of dirty washwater and are configured so one unit is in filtration while the other is in backwash or CIP;
- \* associated ancillary tanks and equipment for backwashing, chemical cleaning and integrity testing of the membranes.

### Regulations

The Water Supply (Water Quality) (Amendment) Regulations 1999 came into force on 30th June 1999, requiring that Southern Water carry out risk assessments to establish whether there is a significant risk from cryptosporidium oocysts in water supplied from treatment works. All surface water supplies are automatically deemed to be of significant risk under the terms of the Regulations. At Otterbourne, the cryptosporidium challenge rate from the river is measured and the existing river stream process is known to effectively remove oocysts.

Following a detailed study and the installation of cryptosporidium monitoring equipment, the groundwater supply was confirmed to be at significant risk. Chlorination alone is not effective against cryptosporidium, therefore, a treatment process was required.

The new works at Otterbourne WSW, being carried out as part of the K3 West programme of works by an integrated team comprising Black & Veatch/Costain and Southern Water included:

The membrane plant will be operated to maintain >4 log removal efficiency of cryptosporidium oocysts. The membrane has a pore size of 0.2 micron and can continuously remove 1-micron particles. Once in place this barrier negates the requirement for continuous monitoring for cryptosporidium oocysts.



ABUS



Arundel Water Supply Works

Photo: George Godden, courtesy: Southern Water.

The membrane plant is housed within a new building approximately 40m x 23m x 9m. It is of steel portal frame construction with a brick outer skin to blend in with existing adjacent buildings.

**Design flows for the membrane plant are:**

**Maximum plant flow     58 MI/d raw water abstraction;**  
**Minimum plant flow     5 MI/d raw water abstraction.**

The new membrane plant was designed on the basis of treating the maximum raw water flow at a maximum raw water turbidity of 1NTU. However, the plant can handle turbidity spikes of up to 4 NTU for limited durations at a reduced plant flow.

With the part of the well/adit system in the chalk aquifer located in the area of construction it was essential to prevent ground water being contaminated by construction activities or materials.

**Wastewater recovery plant**

BVC reinstated and enhanced the existing surface water wastewater recovery plant to reduce the amount of environmental impact and free up sewer capacity to cope with the additional wastewaters produced by the groundwater membrane plant.

**The wastewater recovery plant will comprise:**

- \* **wastewater balancing tank and mixer to balance discharges of clarifier sludge and rapid gravity filter backwash water;**
- \* **thickener feed pumps;**
- \* **polyelectrolyte dosing;**
- \* **WRc type sludge thickener;**
- \* **sludge discharge pumps to send thickened sludge to sewer;**
- \* **supernatant balancing tank;**
- \* **supernatant return pumps.**

One pair of existing wastewater holding tanks were converted for use as the wastewater balancing tank and supernatant balancing tank. The other pair of existing wastewater holding tanks were retained to maintain normal operation during construction of the new waste water recovery plant and to provide additional storage/overflow capacity.

The new wastewater recovery plant was designed to minimise the volume discharged to the sewer and produce a supernatant with turbidity <10 NTU suitable for return to the inlet of the works.

**HV supply**

Scottish & Southern Limited laid a new 11,00V high voltage power cable to the site to cope with the additional demand from the membrane plant. Seeboard Contracting Services Ltd provided the existing borehole and well pump feeders and transformers were enhanced protection and installed a new ring main unit and transformer to provide power to the membrane plant.

**PLC/SCADA**

The existing SCADA platform was not able to support the multiple server-client control system architecture required for the installation of the membrane plant. Cougar Automation Limited in association with Memcor Limited installed Rockwell Automation RSView SE SCADA and ControlLogix PLCs to accommodate the complex sequences and control routines required by the membrane plant.

Control of the various borehole and well pumps remains with the existing Testwood Control Centre, however a SCADA link with Otterbourne enables the operation of the membrane plant to be monitored. In addition the membrane plant automatic controls system limits the number of boreholes and well pumps that can be started by the Controllers at Testwood to the membrane plant's available capacity at any one moment,

**Arundel**

In a similar way to Otterbourne, the water supply works at Arundel was identified as being a site of "significant risk" from cryptosporidium oocysts and has been continuously monitored following the introduction of the same legislation.

Southern Water's works, situated in the Arundel Estate, near Swanbourne Lake, has an abstraction licence of 4.5MI/day

Raw water is abstracted via a borehole pump to supply a population of around 38,000 in the Arundel area and was treated by ultraviolet disinfection and plumbosolvency followed by chlorination to remove nitrates and pesticides. However, this was insufficient to remove cryptosporidium oocysts.

A submerged microfiltration membrane was selected as the best option to be able to provide the required level of treatment and was installed in a building constructed between immovable boundaries including a fish farm, cliffs and several listed buildings.■

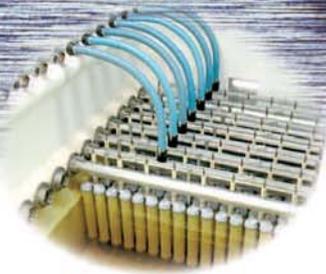
**Note on the authors:** Richard Rumsey is Project Manager & Mark Bulpett, Senior Project Engineer, both with Black and Veatch/Costain.

# USFilter

A Siemens Business

# MEMCOR

## The No. 1 Choice In Membranes.



“

*With MEMCOR...*

*we really did get more.*

*More attention to our needs.*

*More innovative technologies.*

*More service. More answers.*

*And in the end—more value.*

”

Roger Olson,  
Water and Waste Superintendent  
City of Marquette, Michigan  
U.S.A.

## Why?

### You Get MORE...With MEMCOR.

**Better Membranes**—The newest generation of MEMCOR® membranes are outperforming the competition in pilot test after test. MEMCOR leads the industry with durable, monolithic hollow fibers. And the wide variety of MEMCOR membranes means more flexibility and economical treatment options, so you can meet virtually any source water challenge.

**Better Designs**—MEMCOR provides the world's broadest membrane selection: large or small, always operator-friendly and engineered to the highest possible standard—*yours*. With MEMCOR, you can customise your solution, select varying packing densities for optimum solids processing, and have confidence that your system will comply with future regulations.

Drinking Water | Pre-Engineered Systems | Retrofitted Media Filters  
Membrane Bioreactor (MBR) | Water Reuse | Tertiary Filtration  
Seawater Desalination | RO Pretreatment...and More.

**For more information contact:**

**MEMCOR at +44 1332 387 300**

**Email: [info@memcor.co.uk](mailto:info@memcor.co.uk) or Web: [www.memcor.com](http://www.memcor.com)**

**Reliable People. Proven Technologies.™**