Emergency Packaged Water Treatment Plant

6.6Ml/d WTP can be deployed in four shipping containers

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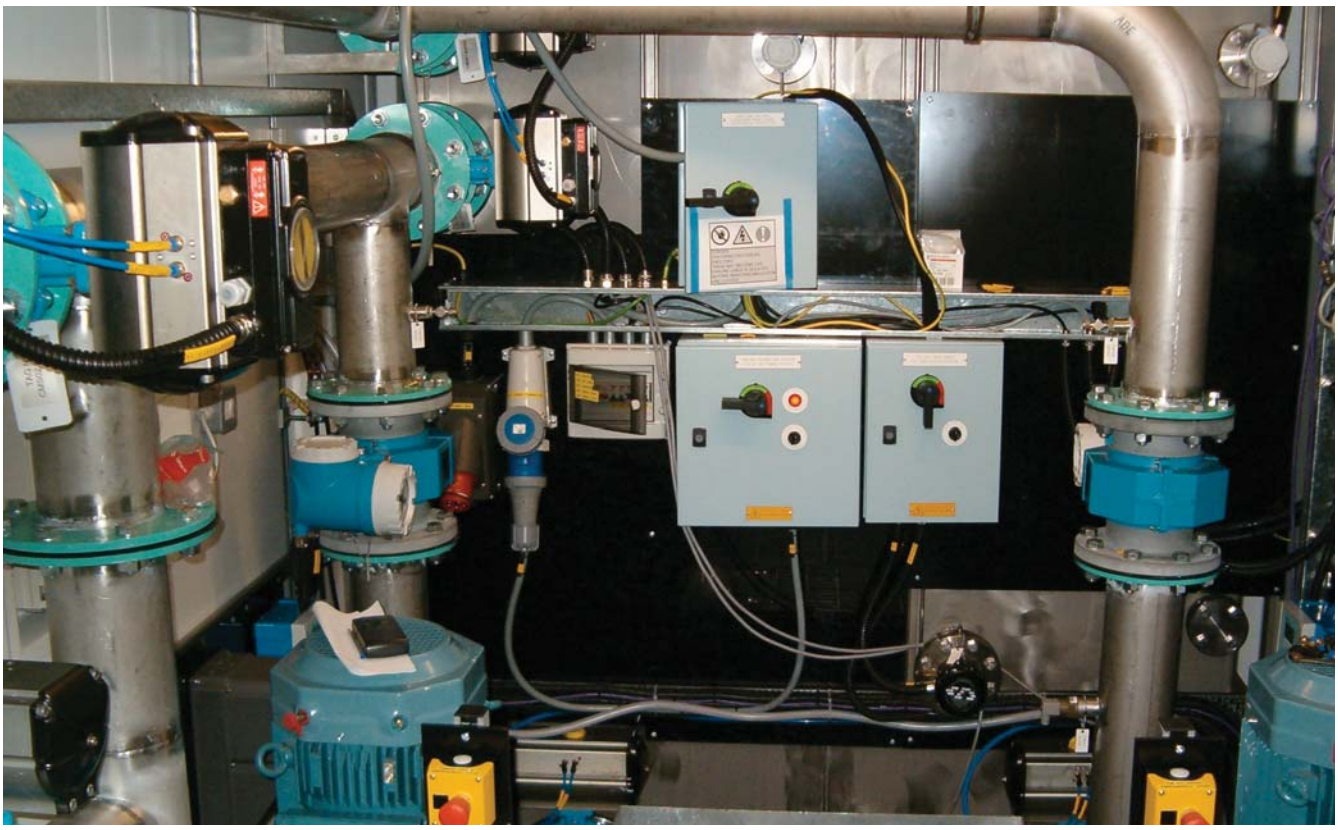
The dry summer of 2003 highlighted the need for additional emergency water treatment equipment capable of rapid deployment to boost water supplies as part of Wessex Water's drought contingency plan. Due to its footprint and flexibility a membrane treatment plant was chosen and a containerised submerged microfiltration membrane plant designed and supplied by *Memcor* was selected. The opportunity was taken at design review to develop the bespoke Memcor system with Wessex Water standards for operation and control. The finished design comprises a plant based in four shipping containers which provide full filtration of up to 6.6Ml/d water supply.



Inside a container the Emergency Packaged Water Treatment plant being fitted out

Photo: courtesy Wessex Water Services

The containers comprise of:

* two which bolt together forming the main process unit with the membranes, filtrate pumps and backwash tank;
* one ancillaries unit containing the control gear, air blowers and chemical storage and dosing for membrane cleaning;
* one coagulant storage and dosing container.

The process comprises of coagulation/flocculation where required for colour removal (eg river water) followed by submerged membrane filtration.

The *Memcor* submerged continuous micro filtration process utilises hollow fibre membranes which can maintain high flow rates by use of a combined air scour and liquid backwash cycle. The membranes are submerged in the feed water tank which continually draws in raw water and produces the filtrate by applying a suction to the filtrate side of the fibres.

The membranes are made of PVDF (polyvinylidene fluoride) material and have a nominal pore size of 0.1 microns which provides a physical barrier to cryptosporidium.

Gradually as deposits build up on the fibres, resistance to flow will increase, resulting in a drop in filtration flow rate. To reduce this resistance and restore the filtration flow rate the membrane is backwashed.

During backwash, filtration is stopped and air from the process blower is applied to the outside of the fibres. A small amount of filtrate is pushed through the fibres (from inside to out) to further remove deposits from the outer surface of the fibres. The cell is then drained to transport the loose deposits to the backwash drain line. The cell is refilled with feed prior to returning to filtration.

A chemical clean in place (CIP) sequence must be initiated at regular intervals to remove any contaminant from the membrane surface not removed by the backwash process. Two types of cleaning regime may be carried out, Sulphuric Acid or Sodium Hypochlorite.

The cleaning sequences are referred to as CIP because there is no requirement to remove the membrane from the cell to perform the clean.

Emergency Pkg Plant unloaded ready to set on base

Photo: courtesy Wessex Water Services

To ensure that the filtration performance is maintained and not compromised by broken or damaged membrane fibres the system self tests. This tests the integrity of the membranes by performing a Pressure Decay Test every day.

In the test, the unit is removed from filtration and the membrane lumens, (centres), are drained and pressurised with low pressure air. The air supply is then removed and the trapped air pressure in the membrane is monitored over an interval. The pressure drop over the interval provides an indication of the membrane integrity. A high pressure drop is indicative of a broken membrane fibre or a damaged/failed 'O' ring.

A unit having a very high decay rate will not be allowed to return to service.

Deployment plans

Deployment plans will be in place for key locations. The flexibility offered means that it could be used as a "bolt on" to an existing works which needed extra capacity or whose filtration had failed. It can also be set up as a stand alone treatment plant for use with river abstraction.

For emergency use the disinfection process would either be provided by hypochlorite dosing or use of existing facilities at a WTW site. Additional treatment may be required depending on the raw water quality.

The backwash waste arrangement will produce 300 cu. m/d which will be stored in additional tanks ready for collection or fed to sewer.

The logistics and infrastructure will be the key challenges to any emergency deployment and the deployment time scale is planned as between 10-14 days.

The limiting factor on this is a suitable commissioning period to ensure stable operation before the plant is put into use.

Storage

The plant has been stored in a secure environment ready for rapid deployment. The membranes are stored in bags as supplied. ■

Note: *The author, Mike Charles is Client Project Manager, Wessex Water.*

Consultants & suppliers

Hyder Consulting - Study & design for drought contingency measures; Lawrence - Drought contingency pipeline preparations; Memcor - Membrane Package Plant; Bridges Electrical - Plant storage, feed supplies and minor civils work.