



Dow Water & Process Solutions

DOW™ Ultrafiltration Treats Coal Mining Wastewater Reused by South African Power Plant

DOW UF technology replaces conventional sand filters to reduce maintenance, cost and environmental impact

Dow Water & Process Solutions is providing Ultrafiltration (UF) Membrane Technology to treat coal mining wastewater for operational reuse at a power station in South Africa. South Africa's primary resource for generating energy is coal, representing more than 80 percent of the country's energy supply.

During the process of power production, coal is burned to generate steam. This steam is used to turn turbines, which, in turn, generates electricity. Current local water resources are stretched, therefore, water reuse is being implemented by the nearby coal mine. The wastewater produced from the coal mining

operations is a threat to the environment. The treated wastewater from the mining operations is now fed to the power station as make up water.

As conventional sand filters and competitor UF technology were found to be ineffective, the coal mine turned to Dow™ UF technology as a pre-treatment to Reverse Osmosis (RO) to recover and reuse the wastewater, which was found to reduce overall cost and help avoid environmental disaster due to nearby water sources being at risk.



The mine stores high salinity and variable suspended solids (TDS 6000 mg/l, NTU 1-30) in an open pond on site. In order to remove suspended and dissolved materials from the wastewater, Dow partnered with a local OEM to rapidly deploy a modular containerized system. Dow UF and RO technology effectively helps to reject particles, colloids, suspended solids, oxidized Fe/Mn and microorganisms from the wastewater.



Initially, 60 Dow UF modules were installed, parallel to five sand filters to treat the water, which has since increased to three UF trains and 180 modules, completely replacing the sand filters. The UF-treated water is further processed by DOW FILMTEC™ BW30-400-FR Reverse Osmosis Elements to remove dissolved salts. Finally, the treated water is transported to a nearby power station, where it is demineralised with Dow Ion Exchange Resin Technology, and used as boiler feed make up water.

Ultrafiltration (UF) Membrane Technology

Dow UF technology was found to have increased advantages over conventional sand filters during pre-treatment, including higher and more consistent filtrate quality, increased feed and turbidity tolerance, lower silt load on the RO, and less frequent CIP (Clean in Place) of the downstream RO, directly lowering chemical use and extending the life of the RO membranes. Dow’s highly automated operation was also found to lower maintenance, and reduce the mine’s environmental footprint. This is due to the unique outside-

in flux configuration within DOW™ Ultrafiltration SFD-2880 Modules that result in less irreversible fouling of membranes, better cleaning possibilities and a wider range of feedwater quality when processing.

The following graphs indicate that the changing feedwater turbidity was completely removed by the UF, whereas conventional sand filters failed to provide consistent outlet turbidity.

Table 1. Sand Filters – RO 1

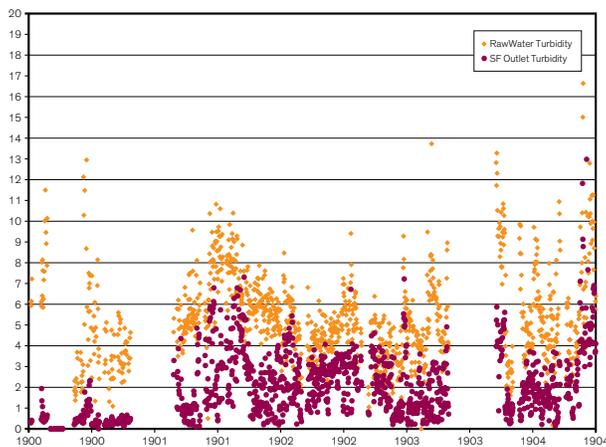
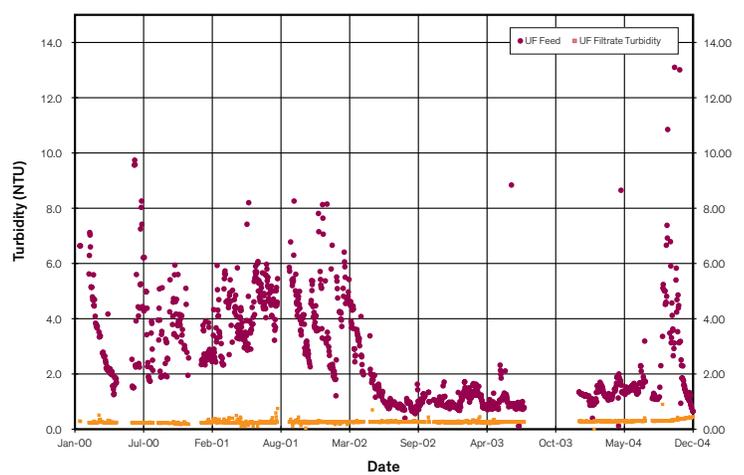


Table 2. Dow UF – RO 2



Over time, the mine’s drainage system experienced a drastic change in feedwater quality, due to increased concentrations of organic material in the wastewater. This in turn caused the growth of microorganisms, thereby contaminating the pond and resulting in flocculent overdose of upstream dissolved air flotation (DAF). As trans-membrane pressure increased and

filtration cycles decreased, more frequent chemically enhanced backwash (CEB), and increased fouling was also detected. Dow technical service representatives investigated the problem, and recommended successful cleaning procedures that restored full membrane functionality to the UF system.

¹ Please see Table 1 and 2 for a comparison of Dow UF and conventional sand filters, when applied in this system.

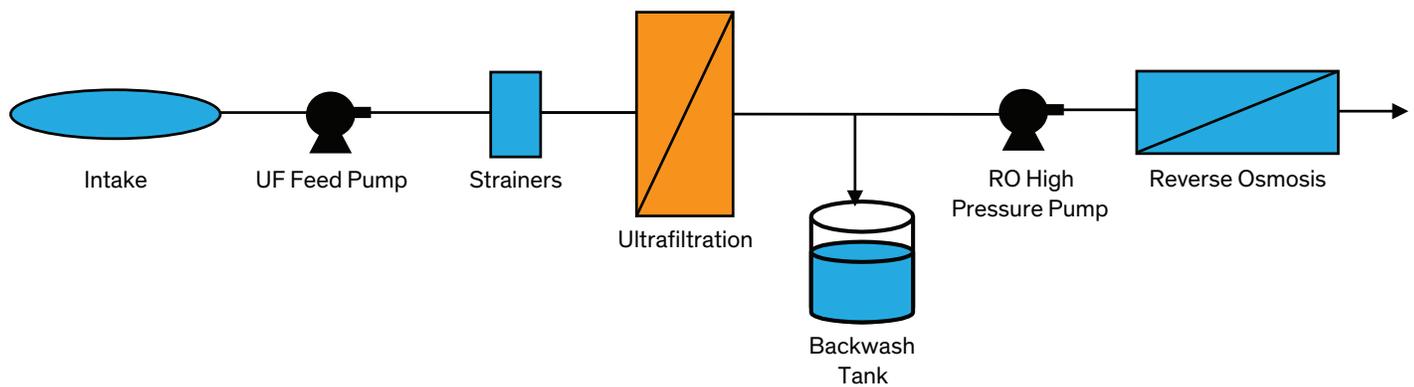
Fast Facts

Country: South Africa
 End-User: Open Cast Coal Mine
 Feed Water Source: High salinity/ Variable suspended solids wastewater
 Feed Water Quality: TDS 6000 mg/l, NTU 1-30
 Plant Capacity: 4,500 m³/day
 Start-Up Date: 2011

Performance

Operating Flux: 50 LMH
 Trans-membrane Pressure (TMP): 0.6–0.8 bar
 UF Turbidity Filtrate Average: < 0.05 NTU

Treated Water Quality (meq/L)			
Ca:	0.760	Cl:	0.208
Mg + Fe:	0.660	SO ₄ :	0.215
Na:	0.539	NO ₃ :	0.002
K:	0.067	HCO ₃ :	1.600
NH ₄ :	0.000		
Total Cations:	2.026	Total Anions:	2.025
		Free CO ₂ :	0.039
Temperature	20°C		
Organics	17.5 mg/L as KMnO ₄		
Approximate pH	8.00 @ 23°C		
Approx. Conductivity	192 µS/cm @ 25°C		



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