



Procedures in an Avista Membrane Element Autopsy:

- External Visual Examination
- Wet Test of the Membrane Element
- Internal Visual Examination
- Chemical Identification of Surface Fouling Using:
 - FTIR Spectrometer
 - Energy Dispersive X-Ray Spectrometer (EDX)
 - Scanning Electron Microscope (SEM)
- Loss-on-Ignition (LOI)
- Cell and Dye Test
- Fujiwara Test
- Summary and Recommendations

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INTRODUCTION

The physical dissection of a reverse osmosis (RO) membrane and the laboratory analysis of its foulants can be one of the most definitive methods of troubleshooting an RO system.

Identifying the type of membrane foulant is the first step in optimizing system performance. With the recommendations in the Avista report, steps can be taken to determine how to begin correcting frequent cleanings, loss of productivity, reductions in permeate quality, system downtime, or frequent membrane replacement.

THE AUTOPSY PROCEDURE

An Avista autopsy includes a comprehensive examination of both the exterior and interior of the membrane as well as an analysis of the foulant layer removed from the membrane surface. The following examinations and tests are performed:

EXTERNAL VISUAL EXAM

A thorough examination is made of the exterior of the membrane element. The inspection looks for damage or defects in the o-rings and brine seal. An examination of the feed and concentrate ends and the outer fiberglass wrapping is also completed.

WET TEST

The membrane is placed in a single element pressure vessel and operated under laboratory conditions. Both feed and pressure drops as well as salt rejection are measured. Fluxes are measured and normalized. The data from this test is compared to the cell test data to differentiate between the condition of the full membrane element vs the cut membrane sample.

INTERNAL VISUAL EXAM

The outer fiberglass wrapping is removed and the membrane is dissected to examine glue lines and to

note any colors and odors. If foulants are present on the membrane surface, a sample is removed for further evaluation.

CHEMICAL ID OF FOULANTS

An FTIR spectrometer is used to determine the nature of any organic foulants. This instrument scans the foulant surface with infrared radiation and plots the absorbance as a function of wavelength. The spectrum acts as a fingerprint of the organic material and is compared with over 10,000 compounds to determine its closest match.

An EDX is used to identify inorganic foulants. A SEM is used to take photographs of the foulant layer and these pictures are included in the completed report.

LOSS ON IGNITION (LOI)

An LOI test is used to obtain a relationship between the amount of organic foulant vs. inorganic foulant.

CELL AND DYE TEST

A cut sample of the membrane is tested for flow and rejection. This data is compared with the test results obtained during the full element wet test. A dye test is also performed to determine if the membrane has been exposed to oxidation or is physically damaged.

FUJIWARA TEST

If the membrane is a polyamide, then a Fujiwara test is conducted. This is currently the most valid indicator of halogenated organics such as chlorine.

SUMMARY & RECOMMENDATIONS

The data from each test is combined to provide an overall summary of the laboratory results. The final segment of the report is from our technical personnel whose recommendations are geared toward reducing the membrane fouling and its associated costs.