Membrane Autopsy:

The initial tool to bring you back to performance

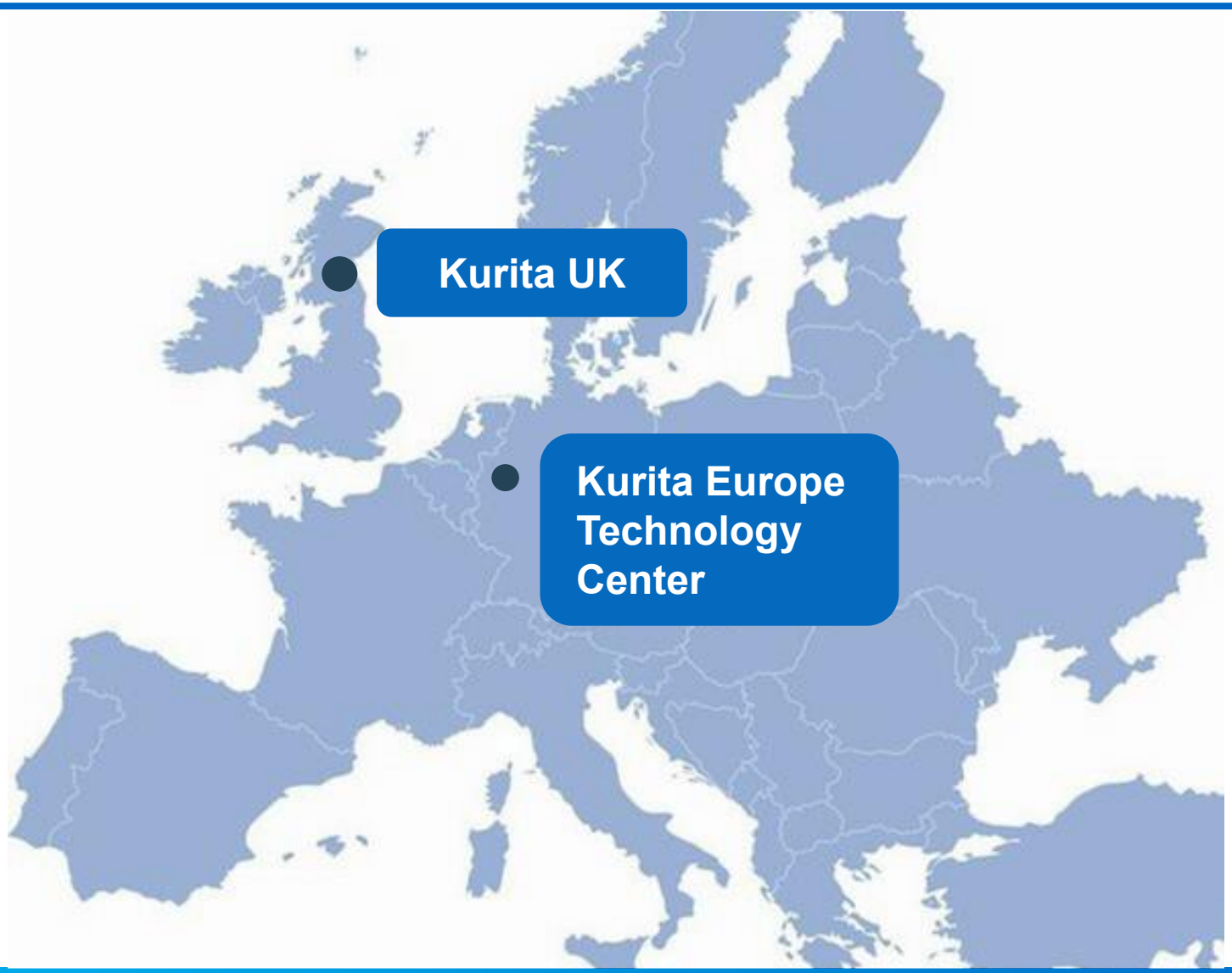
Agenda

Locations

Our Services

Membrane Autopsy Process

Locations in Europe



Introduction

Why Conduct an Autopsy?

- Identify chemical/physical damage
- Identify scaling/fouling problems
- Determine proper cleaning regime
- Determine best RO working conditions

Its Value...

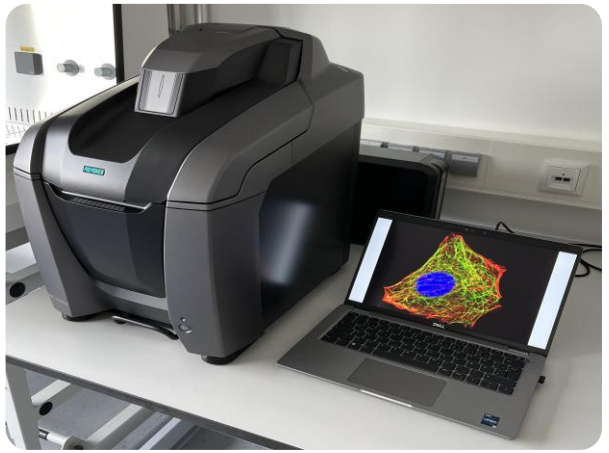
- Improve system performance
- Increase membrane lifetime
- Reduce environmental and operation costs
- Reduce chemical consumption

NEW: Tester & Cleaner unit (4 & 8-inch)

NEW: In-house Analytics for Autopsy

FTIR Spectrometer with ATR

SEM-EDX



Fluorescence Microscope

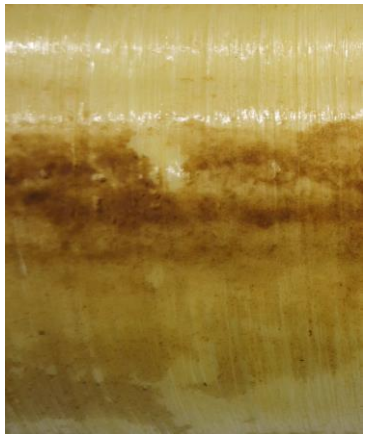
What is a Membrane Autopsy?

Membrane Autopsy Process

1. External Inspection
2. Internal Inspection
3. Foulant Analysis
4. Cleaning Trials
5. Damage determination
6. Projections & Report

External Inspection

- Stress marks/ Cracks / Scratches
- Sealing condition
- Foulant/scaling
- PWT damage
- Debris



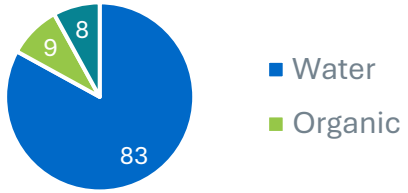
Internal Inspection

- **Membrane Surface:**
  - Foulant/Scaling
  - Physical Damage (Delamination, Creasing)
  - Bypass

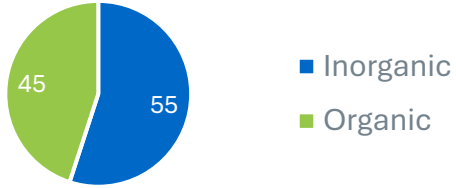
Foulant Analysis

Loss of Ignition

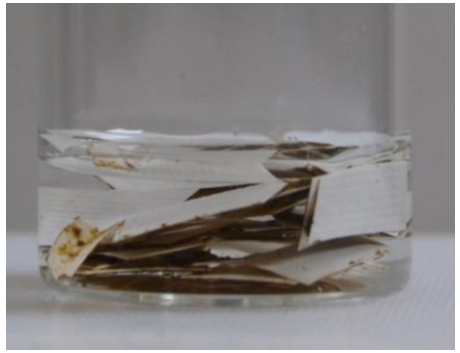
Moisture Content



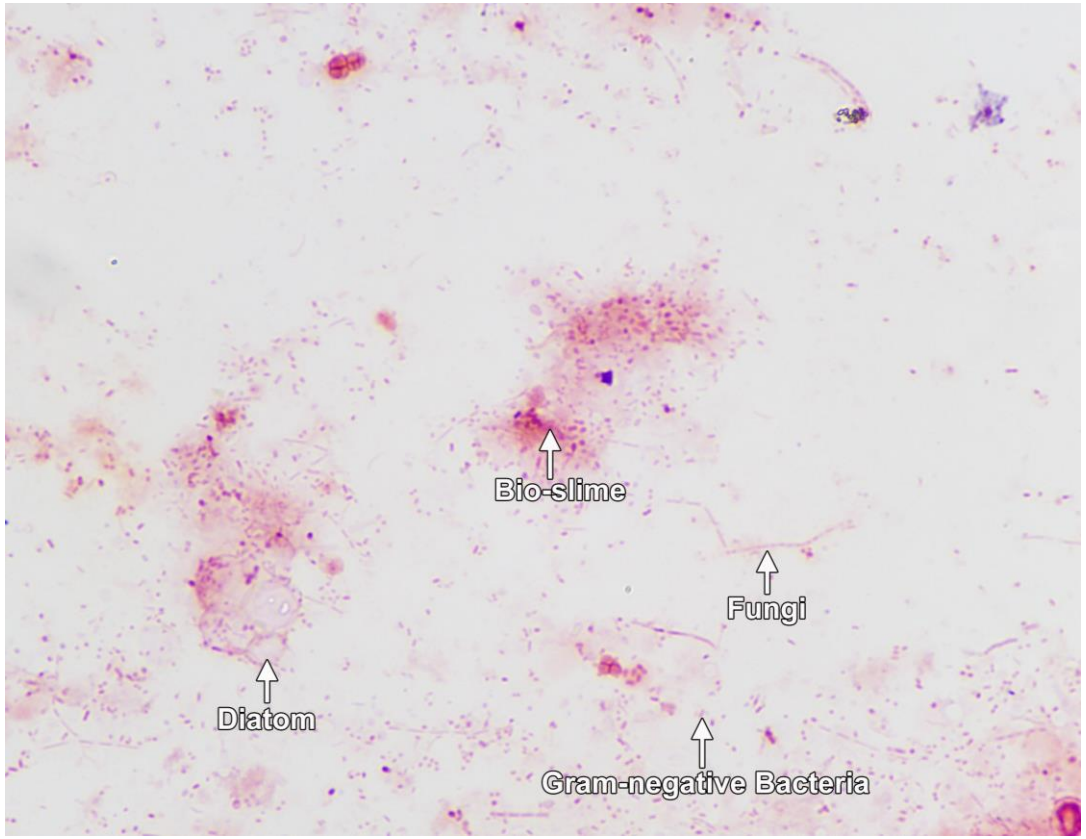
Organic Content



Carbonate Test



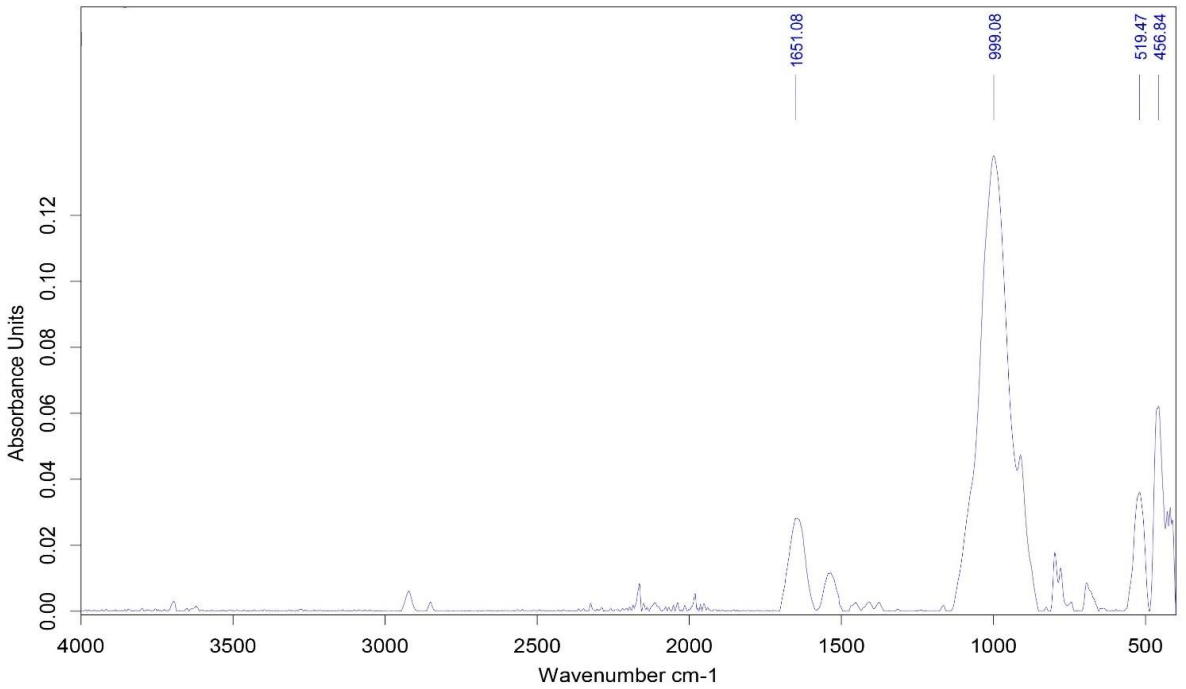
Microscope Analysis



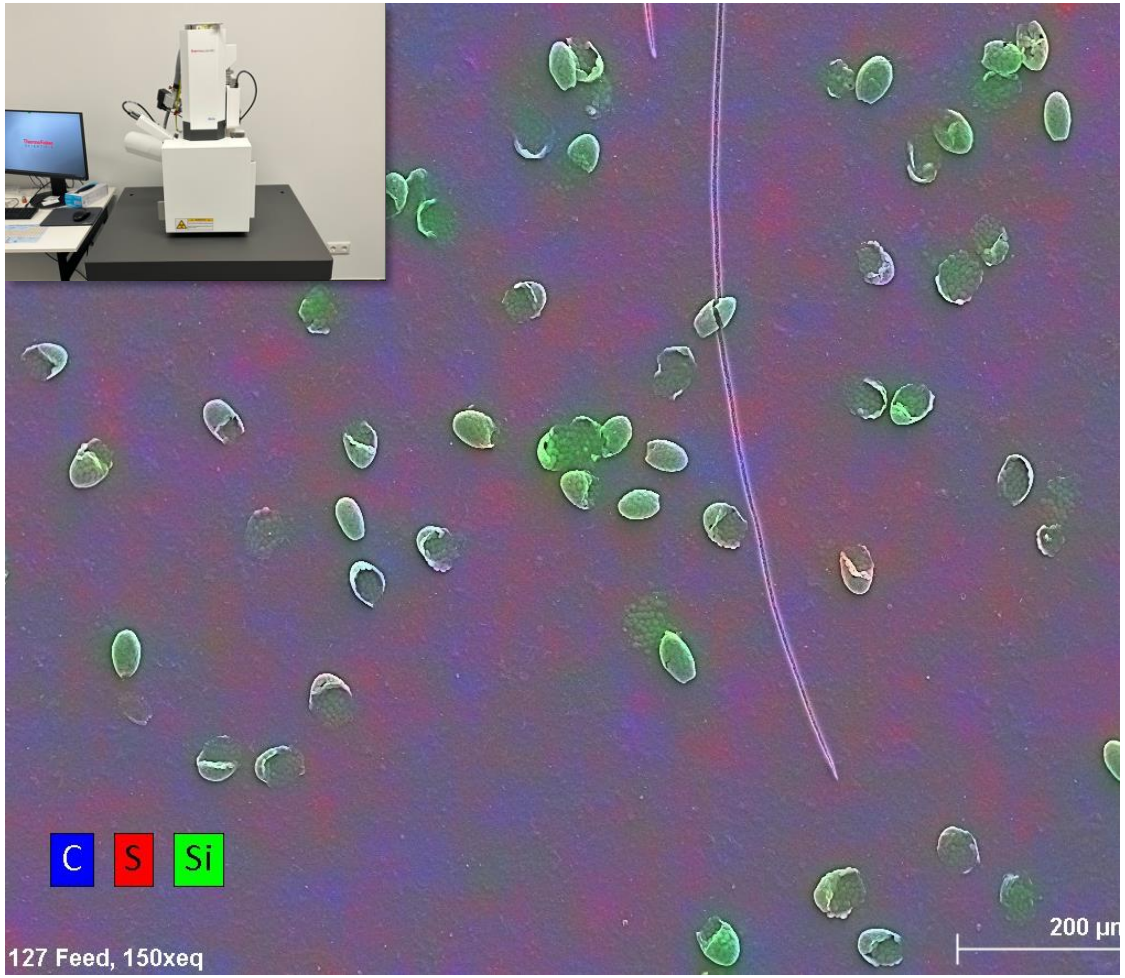
Foulant Analysis

Microscopy Inspection

Infrared Spectroscopy

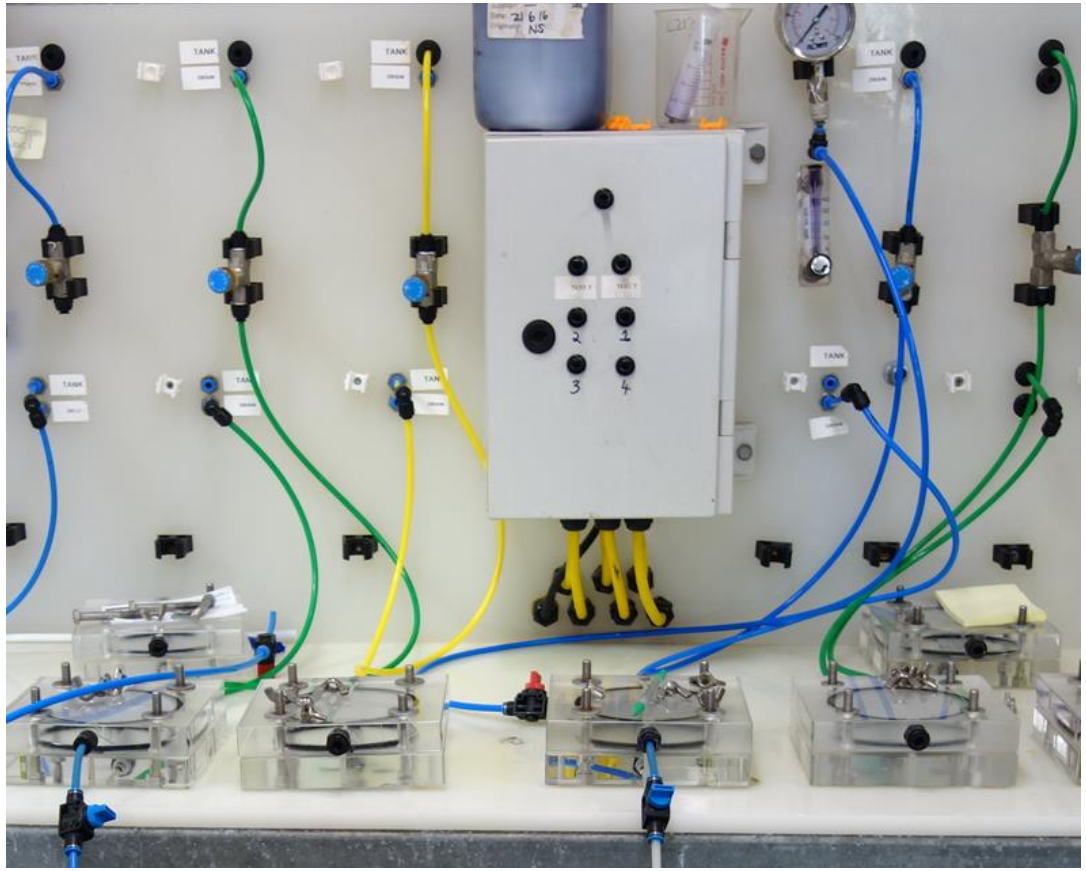


Foulant Analysis- CEI Analysis

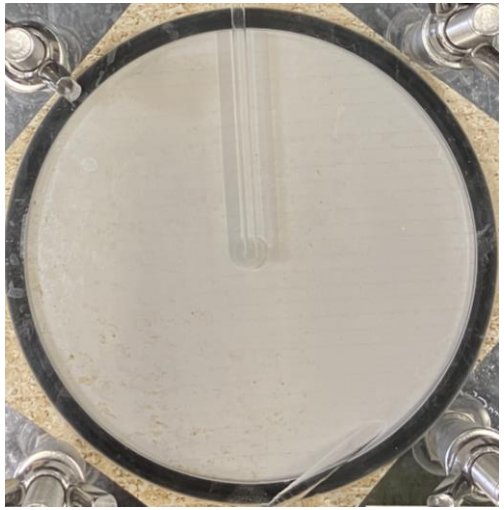


Cleaning Trials

Cell Test Rack



Pre-Clean

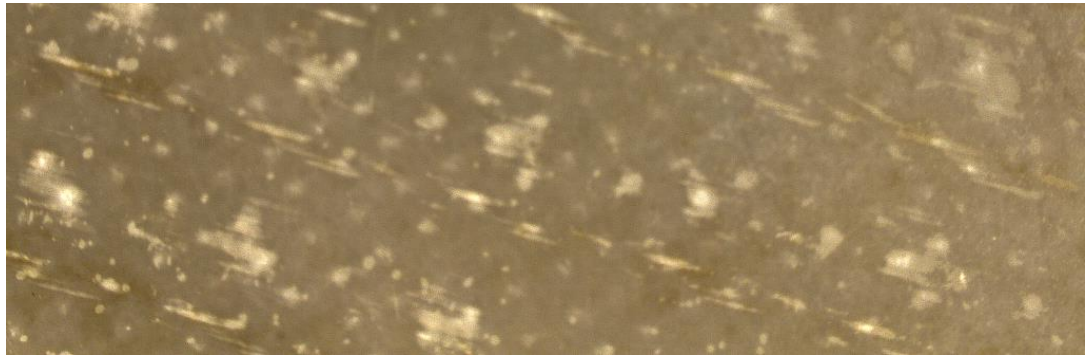


Post-Clean

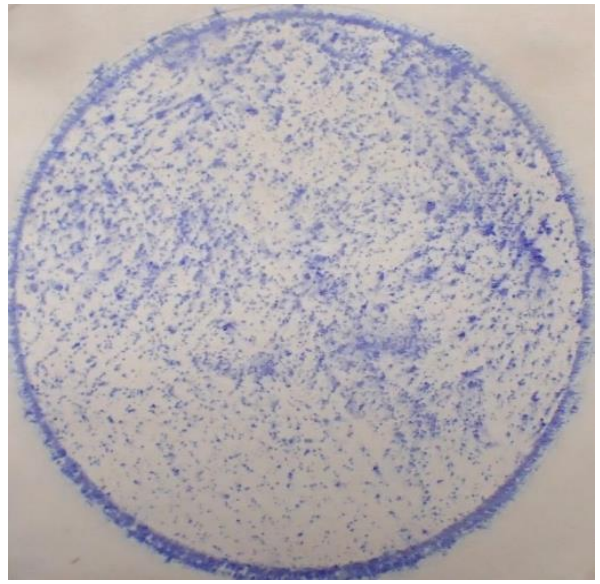
Damage Assessment

Fujiwara test

Backlight Passage



Dye test



Reporting

- Detailed and customized report
- Recommendation letter
- Customized consultation

How to read a Membrane Autopsy Report?

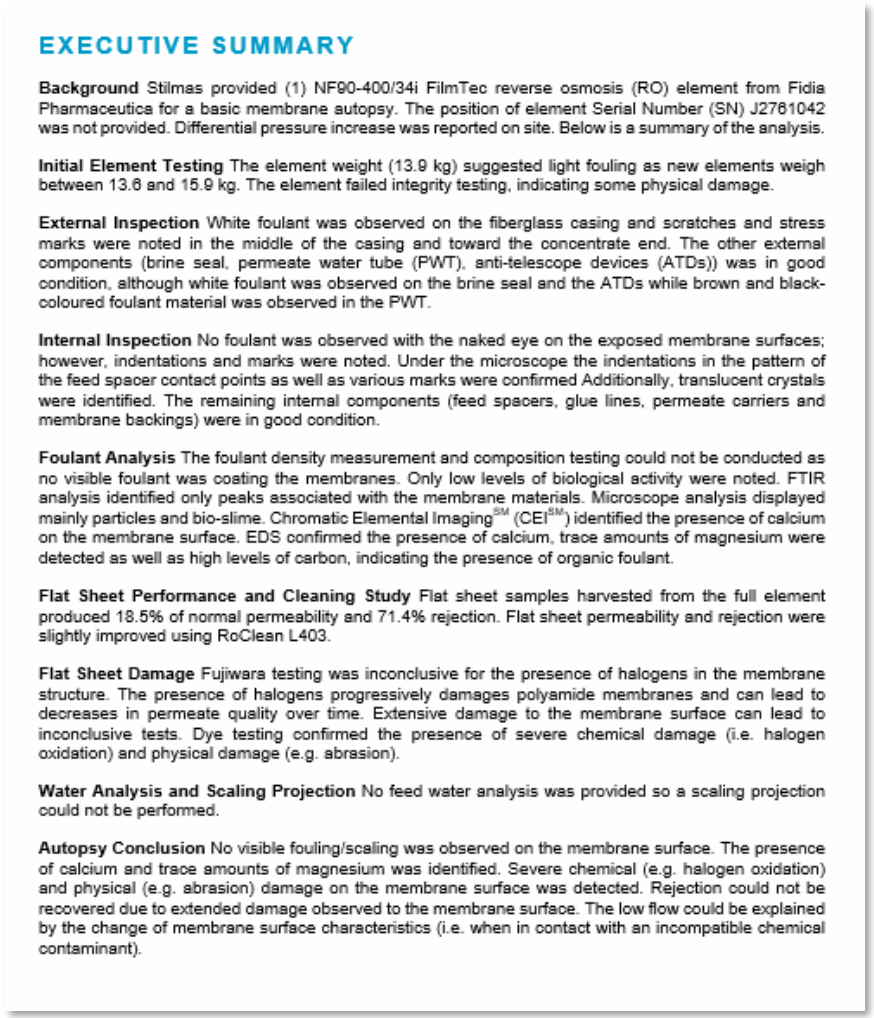
How to read an Autopsy report

Table of Contents

A membrane Autopsy Report provides a lot of valuable information….

But

How to read an Autopsy report



EXECUTIVE SUMMARY

Background Stilmas provided (1) NF90-400/34i FilmTec reverse osmosis (RO) element from Fidia Pharmaceutica for a basic membrane autopsy. The position of element Serial Number (SN) J2761042 was not provided. Differential pressure increase was reported on site. Below is a summary of the analysis.

Initial Element Testing The element weight (13.9 kg) suggested light fouling as new elements weigh between 13.6 and 15.9 kg. The element failed integrity testing, indicating some physical damage.

External Inspection White foulant was observed on the fiberglass casing and scratches and stress marks were noted in the middle of the casing and toward the concentrate end. The other external components (brine seal, permeate water tube (PWT), anti-telescope devices (ATDs)) was in good condition, although white foulant was observed on the brine seal and the ATDs while brown and black-coloured foulant material was observed in the PWT.

Internal Inspection No foulant was observed with the naked eye on the exposed membrane surfaces; however, indentations and marks were noted. Under the microscope the indentations in the pattern of the feed spacer contact points as well as various marks were confirmed Additionally, translucent crystals were identified. The remaining internal components (feed spacers, glue lines, permeate carriers and membrane backings) were in good condition.

Foulant Analysis The foulant density measurement and composition testing could not be conducted as no visible foulant was coating the membranes. Only low levels of biological activity were noted. FTIR analysis identified only peaks associated with the membrane materials. Microscope analysis displayed mainly particles and bio-slime. Chromatic Elemental Imaging℠ (CEI℠) identified the presence of calcium on the membrane surface. EDS confirmed the presence of calcium, trace amounts of magnesium were detected as well as high levels of carbon, indicating the presence of organic foulant.

Flat Sheet Performance and Cleaning Study Flat sheet samples harvested from the full element produced 18.5% of normal permeability and 71.4% rejection. Flat sheet permeability and rejection were slightly improved using RoClean L403.

Flat Sheet Damage Fujiwara testing was inconclusive for the presence of halogens in the membrane structure. The presence of halogens progressively damages polyamide membranes and can lead to decreases in permeate quality over time. Extensive damage to the membrane surface can lead to inconclusive tests. Dye testing confirmed the presence of severe chemical damage (i.e. halogen oxidation) and physical damage (e.g. abrasion).

Water Analysis and Scaling Projection No feed water analysis was provided so a scaling projection could not be performed.

Autopsy Conclusion No visible fouling/scaling was observed on the membrane surface. The presence of calcium and trace amounts of magnesium was identified. Severe chemical (e.g. halogen oxidation) and physical (e.g. abrasion) damage on the membrane surface was detected. Rejection could not be recovered due to extended damage observed to the membrane surface. The low flow could be explained by the change of membrane surface characteristics (i.e. when in contact with an incompatible chemical contaminant).

We found a way to let you move quickly within the report and get the information at your own pace with the Executive Summary.

And

How to read an Autopsy report

If you're interested in quickly checking which tests were successful and which were not, our traffic light system will make your life easier.

The following key will be used throughout the report to demonstrate whether the observation is within or outside normal conditions or if the test was not carried out.

Within normal conditions

Outside normal conditions

Not tested

How to read an Autopsy report

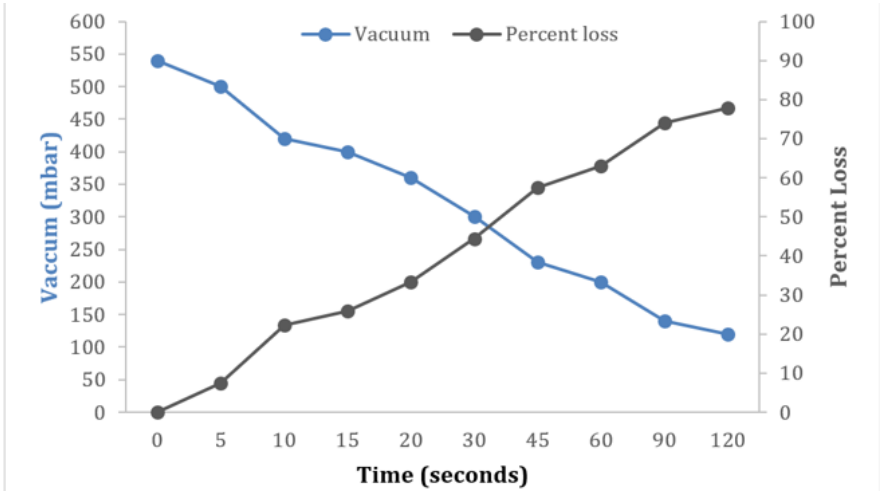
For all the tests we perform, you will find:

Integrity testing is performed to identify mechanical damage to the internal components of the spiral wound element.

The permeate tube is sealed and a vacuum of approximately 400 mbar is applied and monitored for 120 seconds.

Any loss of vacuum indicates the presence of damage; however, losses of over 35% of the vacuum suggests severe mechanical damage.

Results: The element failed the integrity test as it showed significant vacuum loss indicating severe physical damage.



The **name of the test,** along with a **brief description** of what the test is and why we do it.

The **traffic light** indicating if the test was considered successful or not

Detailed results of the test

How to read an Autopsy report

For all the reports we send, you will find at the end:

CERTIFICATION BY LABORATORY

Report Number	Report Content	Element Serial Number	Report Date
PO#06222400353	Standard Membrane Autopsy	J2761042	November 2024

We the undersigned being the technical specialists in membrane autopsy and related testing procedures and protocol for Kurita UK, Avista Centre of Excellence certify to the best of our knowledge and belief that the tests listed in this report have been conducted following Avista's standard testing practices and that the results are accurate and complete.

By signing this certificate neither the laboratory employees nor their employer makes any warranty, expressed or implied, concerning the cleaning study results.

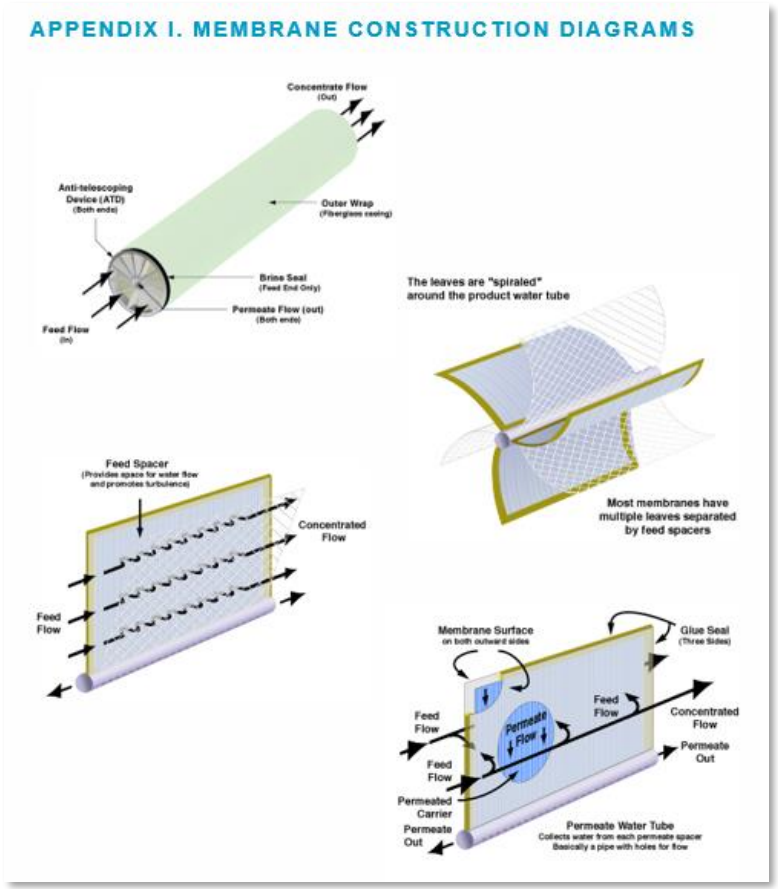
Date: 01/11/2024

Signed:

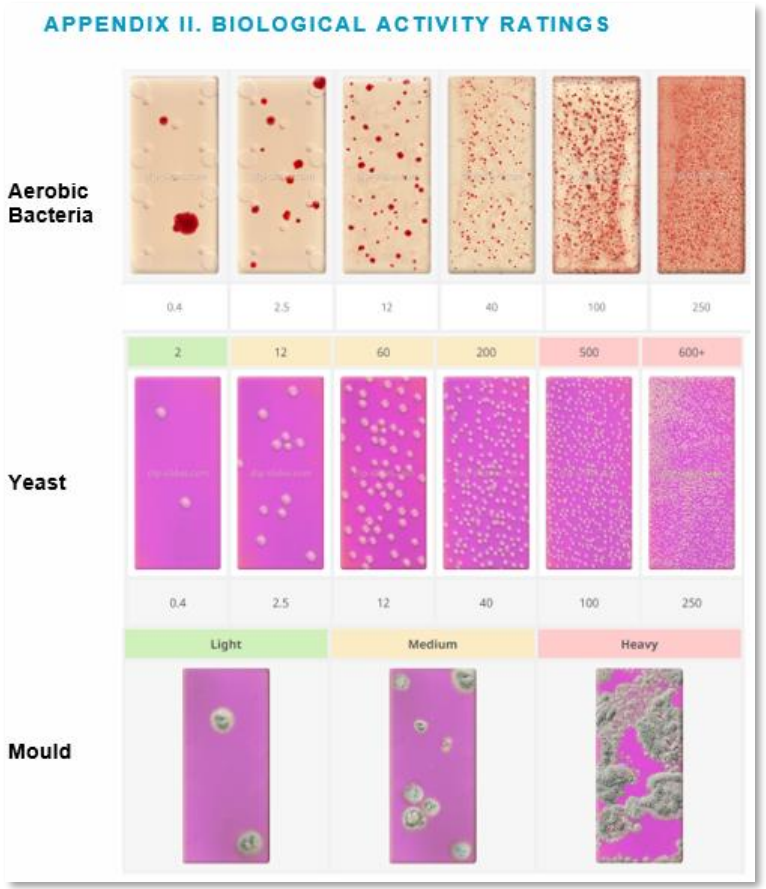
Georgia Skordalou
Product Management Specialist

Adrià Frias Bermudez
Product Management Specialist

Natasha O'Hara
Product Management Specialist



APPENDIX I. MEMBRANE CONSTRUCTION DIAGRAMS



APPENDIX II. BIOLOGICAL ACTIVITY RATINGS


KURITA