

Is there a problem with your membrane system?

Membrane Autopsy is a useful technique for determining causes of fouling events in membrane systems. It can also be used to evaluate the efficacy of pre-treatment methods prior to the membrane units.

The standard autopsy is designed to provide a broad overview of the condition of the membrane element, and determine the type and extent of

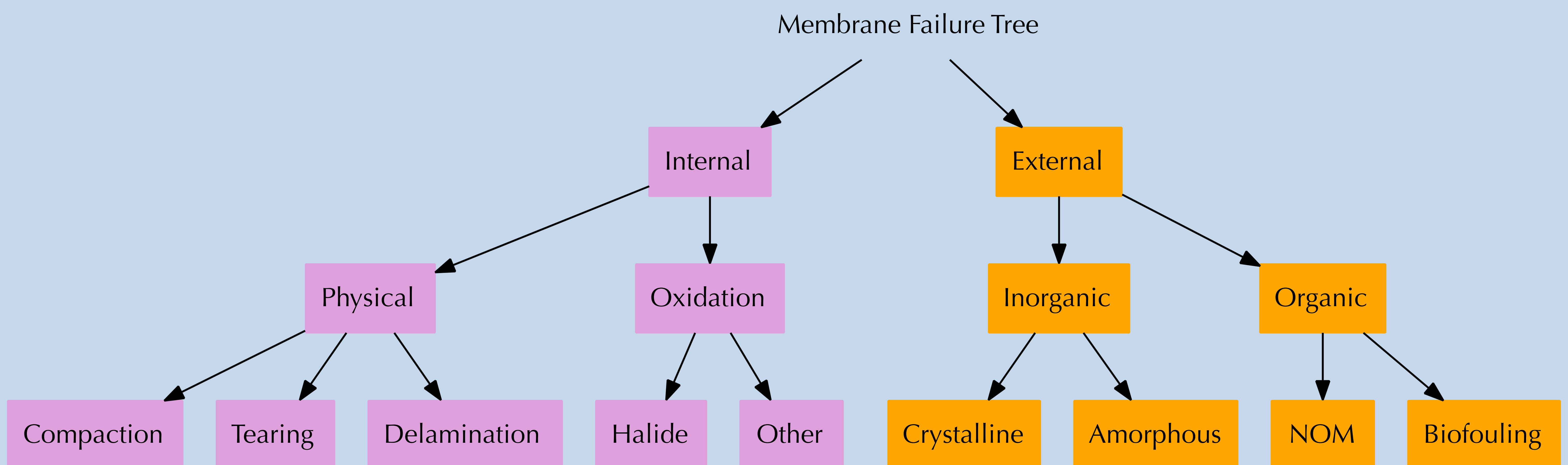
fouling on the membrane surface.

A standard autopsy includes the following techniques:

- Internal and external visual examination
- Scanning electron microscopy (SEM)/Energy dispersive x-ray spectroscopy (EDS) Dead-end wet testing and comparison with fresh membranes

- Dye integrity testing
- Halide damage testing via the Fujiwara test
- Inductively coupled plasma (ICP)/Optical emission spectroscopy (OES/AES)
- Microbial analysis
- Loss on ignition testing (LOI)
- Fourier transform infrared spectrometry (FTIR)
- X-Ray Diffraction (XRD)
- Total organic carbon (TOC) analysis

Fouling and Failure



Fouling occurs in all membrane systems and the general operating principle is not how to eliminate fouling but how can it best be managed. This usually occurs in the form of pre-treatment of the feed water, dosing the feed water with chemicals such as acid or base to modify the pH or anti-scalants. Cleaning strategies also form an integral

part of fouling management.

When conducting an autopsy it is usually on the premise that the fouling management process has failed and the aim of the autopsy is to identify the root cause of the fouling event and provide some recommendation on how to correct or manage it.

When examining membrane fouling and failure in high pressure membrane systems such as nanofiltration and reverse osmosis there are a small number of distinct ways in which it may occur.

The above fault tree describes the general categories under which failure or fouling can be classified.

When is an Autopsy undertaken?

- A loss of performance is observed such as:
 - High permeate conductivity/ low rejection
 - High TMP
 - High ΔP
 - Decrease in product flux
 - Increased frequency of cleaning
- Other reasons
 - End of trials
 - To determine the long term effects of cleaning methods
 - After an incident or mishap within the system

The autopsy tree briefly describes the general process under which an autopsy is undertaken in order to identify the cause of membrane fouling or failure.

Tools for analysis

The autopsy consists of three steps. Prior to conducting the autopsy, initial information is obtained from the supplier of the membrane including:

- Feedwater and system characteristics
- Normalised performance history

The second step is the autopsy itself. Samples are taken, analysed and the results collected. The final step is the analysis and interpretation of results with reference to the initial information.

The results are also compared to and cross-referenced with the autopsy database. The autopsy data is then stored on the database and used as reference material for further work.

