NANOH2O QuantumFlux™ MBR/Submerged UF Membrane

Technical Service Bulletin 809

Data Logging and Performance Monitoring

In order to properly troubleshoot MBR & Submerged UF module performance issues, identify system operational issues, develop cleaning and maintenance procedures, and ensure the validity of the product/system warranty, it is critical that feedwater quality and system performance data be recorded and logged on a regular basis such that information is readily available for review in the event of a performance problem or a warranty claim.

Why is Data Collection Important?

UF/MBR membrane performance can be affected by a variety of factors, such as a change in feedwater quality or a change in operating conditions; the only way to determine whether your membranes are performing as expected is through regular collection and routine analysis of feedwater quality and system performance data. This information can then be evaluated over time to determine whether membrane performance is tracking as expected or if adverse trends develop which then require corrective action. All data collected should be systematically logged for future access to allow analysis of longer-term performance trends that may require troubleshooting or support a warranty claim.

> CAUTION
>
> Failure to maintain the minimum data logging requirements identified herein or to make such data available to NANOH2O upon request may result in voiding your product/system warranty.

Data Storage Requirements

All monitored parameters require secure storage in a database system including the following:

- Operational data
- Integrity test results
- Calibration records

Trend Analysis

Automated trend analysis should be configured to identify:

- Gradual TMP increases indicating fouling
- Sudden permeability changes suggesting membrane damage
- Deviations from normal operating patterns
- Long-term performance degradation

Quality Control

Data validation protocols must include automated range checking and error flagging. Systems should incorporate redundant sensors for critical parameters and automatic notification of sensor disagreement exceeding 5% variation.

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Calibration and Maintenance

- Sensor Calibration
- Establish regular calibration schedules
- Pressure transmitters: Quarterly verification
- Flow meters: Semi-annual calibration
- DO sensors: Weekly calibration
- MLSS sensors: Monthly calibration
- Turbidity meters: Weekly calibration

Data Collection Procedures

The following tables identify the data to be regularly collected and the frequency of collection.

NANOH2O Submerged UF/MBR Membrane Minimum Logging Requirements

Membrane Tank Fluid Characteristics - Required Data:

Parameter	Frequency of Collection	Comment or Unit of Measure
Sludge Temperature, °C (°F)	Every 15 mins	Via SCADA System
Membrane Tank MLSS, mg/L	Every 15 mins	Via SCADA System
Membrane Tank DO, mg/L	Every 15 mins	Via SCADA System
Filtrate Soluble BOD5, mg/L	Every 15 mins	Via SCADA System

UF/MBR Each Train – Required Data:

Parameter	Frequency of Collection	Comment or Unit of Measure
Membrane Tank Level, m (ft)	Every 15 mins	Via SCADA System
Filtrate pressure, kPa (psi)	Every 15 mins	Via SCADA System
Filtrate Flow, m^3/h (GPM)	Every 15 mins	Via SCADA System
Air flow rate delivery, m^3/h (acfm)	Every 15 mins	Via SCADA System
Filtrate turbidity, NTU	Every 15 mins	Via SCADA System

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Operating or Maintenance Events for UF System or Each Train:

Parameter	Frequency of Collection	Comment or Unit of Measure
System or Train Start-up	As applicable	Record date and time
System or Train Shutdown	As applicable	Record reason for shutdown, date, and time
Membrane Recovery Clean (RC)	As applicable	Record reason for cleaning, chemical(s) used, method or procedure, concentration, date and time. Record results following cleaning.

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Sludge Quality Testing for MBR

The performance of the membranes in a MBR system depends heavily on the performance of the biological system. Analytical tests do not capture the whole picture and may or may not be very useful for troubleshooting. The following tests are useful for qualitatively checking the sludge quality, as it relates to membrane fouling potential. These tests are qualitative. Performing these tests daily from plant start-up will eventually generate a data set which reveals trends between the test results and membrane performance. Comparing the trends alongside associated analytical test results (e.g. feed and filtrate BOD, COD, etc.), biological system operating data (DO concentration, temperature, MLSS, etc.), and membrane system operating data (TMP, flux, air scour flowrate, etc.) will enable easier troubleshooting.

Filterability Test

Prepare the following supplies:

- 100 mL graduated cylinder (2)
- Circular 1 micron rated filter paper large enough for 100 mL funnel
- 100 mL funnel
- Stopwatch

Use the following procedure:

1. Prepare a filter paper rated at 1 micron by folding 6 times into a conical shape with accordion style bends. There should be 12 bends, with each neighboring bend alternating up, then down.
    a. It is critical to use the same type of filter paper and bend it the same way every time. Otherwise, the results may not be relatable.
    b. Place the filter paper in the funnel.
    c. Pour 50 mL of tap water through the filter paper, then allow filter and funnel to dry for 30 minutes.
    d. Place the funnel outlet over the 100 mL graduated cylinder. Support, as needed, to prevent the funnel from falling over.
    e. Collect >50 mL representative sample of mixed liquor (sludge) from the membrane tank.
    f. Pour 50 mL of the solution into the other 100 mL graduated cylinders.
    g. From the 100 mL graduated cylinder, slowly pour the solution into the funnel with the filter paper collecting the filtrate in the other 100 mL graduated cylinder.
        a. Start the stopwatch when you start pouring.
    h. Stop pouring the solution after 5 minutes and remove the funnel outlet from the graduated cylinder. During this period, you will have to repeatedly top off the solution in the funnel.
    i. Measure and record the volume of filtrate collected, as “Filterability Test – Filtrate Volume (5 mins)”.

Changes in filterability test filtrate volume from one day to another would indicate a possible lowering of flow through the MBR membranes.

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Sludge Volume – 30 minutes (SV30) Test

Prepare the following supplies:

- 1000 mL graduated cylinder
- Stopwatch
- 10 mL pipet
- Handheld turbidimeter

Use the following procedure:

1. Collect 250 mL of sludge from the membrane tank in a graduated cylinder. (Use the same sludge volume every time.)
2. Dilute with filtrate until the volume reaches 1000 mL.
3. Mix the solution. This results in a 4:1 dilution ratio
4. Place the graduated cylinder on a level surface.
   a. Start the stopwatch.
5. After 30 minutes, observe and record the volume, in ml, of sludge settled in the graduated cylinder, as "SV30 – Sludge Volume" in ml/L.
6. Use the pipet to extract the clearest supernatant present.
7. Measure and record the turbidity of the supernatant, as "SV30 – Supernatant Turbidity".

The SV30 sludge volume should be in the range of 150 – 300 ml/L.

A higher SV30 turbidity from one day to another may be the result of less flocculation and hence increase in membrane fouling.

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Analytic Measurements

There are many parameters to monitor in the biological system which are beyond the scope of this manual.

Location		Feed to MBR	Filtrate	Membrane Tank	Frequency
Biochemical Oxygen Demand (BOD)	mg/L	X	X		Once per day
Chemical Oxygen Demand (COD)	mg/L	X	X		Once per day
Total Kjeldahl Nitrogen (TKN)	mg/L	X	X		Once per day
Ammonium-Nitrogen (NH_4-N)	mg/L	X	X		Once per day
Total Nitrogen (TN)	mg/L	X	X		Once per day
Total Suspended Solids (TSS)	mg/L	X	X		Once per day
Volatile Suspended Solids (VSS)	mg/L	X			Once per day
Total Phosphorus	mg/L	X	X		Once per day
Alkalinity (as $CaCO_3$)	mg/L	X	X		Once per day
Total Dissolved Solids (TDS)	mg/L	X			Once per day
Hardness	mg/L	X	X		Once per day
pH	S.U.	X	X		Once per day
Oil and Grease	mg/L	X		X	Twice a week