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Standard Guide for Recordkeeping for Reverse Osmosis and Nanofiltration Systems[1]

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1. Scope

1.1 This guide covers procedures for well-defined recordkeeping of reverse osmosis (RO) and nanofiltration (NF) systems.

1.2 This guide includes a start-up report, recordkeeping of RO and NF operating data, recordkeeping of pretreatment operating data, and a maintenance log.

1.3 This guide is applicable to waters including brackish waters and seawaters but is not necessarily applicable to wastewaters.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1125 Test Methods for Electrical Conductivity and Resistivity of Water

D1129 Terminology Relating to Water

D1253 Test Method for Residual Chlorine in Water

D1889 Test Method for Turbidity of Water (Withdrawn 2007)[3]

D3739 Practice for Calculation and Adjustment of the Langelier Saturation Index for Reverse Osmosis

D4189 Test Method for Silt Density Index (SDI) of Water

D4194 Test Methods for Operating Characteristics of Reverse Osmosis and Nanofiltration Devices

D4195 Guide for Water Analysis for Reverse Osmosis and Nanofiltration Application

D4582 Practice for Calculation and Adjustment of the Stiff and Davis Stability Index for Reverse Osmosis

D6161 Terminology Used for Microfiltration, Ultrafiltration, Nanofiltration and Reverse Osmosis Membrane Processes

3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide, refer to Terminology D1129 and D6161.

4. Significance and Use

4.1 Proper operation and maintenance of RO and NF systems are key factors in obtaining successful performance. This guide provides the necessary input for the evaluation of the performance of the RO and NF systems, the pretreatment system, and the mechanical equipment in the plant.

4.2 This guide is for general guidance only and must not be used in place of the operating manual for a particular plant.

4.3 Site-dependent factors prevent specific recommendations for all recordkeeping. Thus, only the more general recordkeeping is covered by this guide.

4.4 This guide can be used for both brackish and seawater systems which contain either spiral-wound or hollow-fiber devices.

5. Procedure

5.1 *Start-Up Report:*

5.1.1 Provide a complete description of the RO or NF plant. This can be done by using a flow diagram and equipment, instrumentation, and material lists to show water source, pretreatment system, RO or NF configuration, and posttreatment system.

5.1.2 Record initial performance of RO or NF and pretreatment systems as provided in 5.2 and 5.3, respectively.

5.1.3 Calibrate all gauges and meters based on manufacturers' recommendations.

5.2 *RO or NF Operating Data (see D4194):*

[1] This guide is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.08 on Membranes and Ion Exchange Materials.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

5.2.1 Record the permeate and brine flows of each stage in the RO or NF system.

5.2.2 Record the feed, permeate, and brine pressures of each stage. For hollow-fiber devices also record the brine pressure for each permeator.

5.2.3 Record the water temperature of the feed stream after the RO or NF pump or of the permeate stream.

5.2.4 Record the pH of the feed, permeate, and brine streams.

5.2.5 Record the conductivity of the feed, permeate, and brine streams for each stage. For hollow-fiber devices, also record the brine conductivity of each permeator. For conductivity measurements use Test Methods D1125.

5.2.6 Record the Silt Density Index (SDI) or turbidity of the RO or NF feed stream, or both. For SDI measurements use Test Method D4189. For turbidity measurement use Test Method D1889 (nephelometric turbidity).

5.2.7 Record the Langelier Saturation Index (LSI) of the brine stream from the last stage. For LSI determination use Practice D3739.

NOTE 1—For brackish water applications with RO brine streams >10 000 mg/L total dissolved solids and for seawater, the Stiff and Davis Stability Index (S&DSI) is used for some RO devices instead of the LSI. Consult the supplier of the RO system to determine the index to be used. For S&DSI determination, use Practice D4582.

5.2.8 Record the hours of operation whenever RO or NF data are collected.

5.2.9 Calibrate all gauges and meters based on manufacturer's recommendation as to method and frequency, but no less frequent than once every three months.

5.2.10 Record any unusual incidents, for example, upsets in SDI or turbidity, pH and pressure, and shut-downs.

5.2.11 Complete water analyses of the feed, permeate, and brine streams and the raw water shall be obtained at start-up and every three months thereafter and shall include the following:

Calcium
Magnesium
Sodium
Potassium
Strontium
Barium
Iron (Total, Dissolved and Ferrous)
Aluminum (Total and Dissolved)
pH
Hydrogen Sulfide
Bicarbonate
Sulfate
Chloride
Nitrate
Fluoride
Phosphate (Total)
Silica (Dissolved)
Total Dissolved Solids
Conductivity

For all analyses use ASTM test methods referenced in Guide D4195.

5.2.12 Obtain the TDS of the feed, permeate, and brine for each stage once a month.

5.2.13 Obtain the chloride ion and conductivity of the feed, permeate, and brine for each stage twice a week.

5.2.14 The recommended frequency of data collection is given in Table 1.

TABLE 1 Recommended Frequency of Data Collection

	Every 8 h	Daily	Weekly	Monthly
Flows	X[A]	X		
Pressures:				
system (by stages)	X[A]	X		
permeator (brine port)			X[A]	X
Temperature	X[A]	X		
pH	X[A]	X		
Conductivity:				
system (by stages)	X[A]	X[A]		
permeator (brine port)			X[A]	X
SDI or turbidity, or both	X[A]	X		
LSI			X	
Unusual incidences	on occurrence			

[A] The size of the RO system and its operator coverage will determine a practical frequency.

5.3 *Pretreatment Operating Data:*

5.3.1 Record the operating characteristics of the pretreatment equipment. Since pretreatment is site dependent, specific recommendations for all record keeping cannot be given.

NOTE 2—Unless known to be completely absent, measure the concentration of total residual chlorine in the RO feed daily. Use Test Method D1253.

5.3.2 Record discharge pressure of any well or booster pumps twice a day.

5.3.3 Record inlet and outlet pressure of all filters twice a day.

5.3.4 If used, record consumption of acid and any other chemicals once a day.

5.3.5 Calibrate all gauges and meters based on manufacturer's recommendations as to method and frequency, but no less frequent than once every three months.

5.3.6 Record any unusual incidents, for example, upsets and shutdowns, as they occur.

5.4 *Maintenance Log:*

5.4.1 Record routine maintenance.

5.4.2 Record mechanical failures and replacements.

5.4.3 Record replacements or additions of RO or NF devices.

5.4.4 Record calibrations of all gauges and meters.

5.4.5 Record replacement or additions of pretreatment equipment, for example, cartridge filters and include date, brand name, and nominal rating.

5.4.6 Record all cleanings of RO or NF devices. Include date, duration of cleaning, cleaning agent(s) and concentration, solution pH, temperature during cleaning, flow rate, and pressure.

6. Keywords

6.1 nanofiltration; operating data; recordkeeping; reverse osmosis