5-3. Record Keeping for Maintenance

All relevant data of the RO system is strongly recommended to be recorded properly. They are not only necessary for following the performance of the system, but also valuable tools for trouble shooting and also needed in the cases of warranty claims.

The RO system performance depends for the most part on the proper operation of the pretreatment and thus the operating characteristics of the pretreatment equipment for the following items should be recorded and maintained.

5-3-1. Pre-treatment System

- Discharge pressure of any well or booster pumps and pressure drop of all filters including sand filter, multi media filter, and activated carbon filter. The data of the pressure drop may indicate when a backwash for the filters is needed
- Total residual chlorine concentration in the RO feed
- Regeneration period of water softener if used for the removal of hardness
- Inlet and outlet pressure of micro-filters and cartridge filters. An increase in the differential pressure between inlet and outlet pressure may indicate the time for cleaning and backwashing of the micro-filters or a replacement of cartridge filters
- Silt Density Index (SDI) and turbidity of the RO feed stream. Measure SDI and the turbidity before and after all the filters
- Consumption of acid and any other chemicals such as coagulants and scale inhibitors. Scale inhibition can also be accomplished by pH control (usually pH 6-7), depending on the amount of hardness in the feed water

5-3-2. RO Operating Data

The following data must be recorded frequently, preferably once per shift.

- Complete water analysis of the feed, permeate and concentrate water and the raw water before pre-treatment once at start-up and every week thereafter
- pH of the feed, permeate and concentrate water and temperature of the feed water
- Langelier Saturation Index (LSI) of the concentrate water from the last array (for concentrate water < 10,000 ppm TDS)
- Stiff and Davis Saturation Index (S&DSI) of the concentrate water from the last array (for concentrate water > 10,000 ppm TDS)

- Feed flow pressure after high pressure pump
- Feed, permeate and concentrate flow pressure of each array. Pressure drop per cartridge and per array
- Permeate and concentrate flows of each array. Calculate recovery ratio to ensure that it does not go beyond the design limit
- Conductivity/TDS of the feed, permeate and concentrate streams for each array. The TDS of the RO concentrate can be used along with the feed water TDS to calculate an average membrane concentration which can be used to calculate an average membrane salt rejection as shown in the following equations

$$Q_p \times C_p + Q_c + C_c = Q_f \times C_f$$

where Q means a flow and C means a TDS. Subscript *p, c, f* means a permeate, concentrate and feed each

$$\text{Average salt rejection (\%)} = \left(1 - \frac{C_p}{C_{fc}}\right) \times 100$$

where C_p = permeate concentration

C_{fc} = average concentration of feed and concentrate

- Calibration of all gauges and meters based on manufacturer's recommendations at least once every three months. Important gauges include pH meters, flow meters, pressure gauges, and conductivity meters. It is recommended that the water pH is verified weekly and on a weekly schedule, the pH probe should be placed into buffer solutions with particular pH values, calibrating the probe to those values. If the values are drifting every time the pH meter is checked, the reference probe needs to be replaced or have its KCl solution replenished

5-3-3. Maintenance Log

- Record regular maintenance
- Record mechanical failures and replacements or additions of RO devices and pre-treatment equipment such as cartridge filters
- Record any change of membrane element locations with element serial numbers
- Record calibration of all gauges and meters
- Record all cleanings of RO membranes including date, duration of cleaning, cleaning agents and concentration, solution pH, temperature, flow rate and pressure
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