RO Membrane Cleaning

Providing a Spot Free Rinse cycle in a Carwash typically involves the installation of a Reverse Osmosis System (RO). The RO is designed to minimize total dissolved solids (TDS) from the feed stream. Dissolved solids can come from a variety of sources and are present in virtually all water supplies. The amount of TDS present determines whether or not you can provide a spot free solution in your wash. The industry standard for spot free rinse water is less than 40 ppm (parts per million) TDS. The product water after the RO system is predicated on the amount of TDS in the feed water to be treated. Most RO membranes can remove on average 98% of the dissolved solids in the water. Typical feed water from most city water supplies are less than 500 ppm therefore the expected results after the RO system is approximately 10 ppm.

There are several membrane manufacturers and types of membranes available. The most widely used membranes in a carwash application is a thin film composite membrane (TFC). There are several types available including high rejection, high flow, low fouling and low-pressure configurations that can be applied depending on the feed water source. The RO manufacturer can provide guidance via a projection that can be done on the source water.

All RO systems eventually will require cleaning. Cleaning is recommended when your RO shows evidence of fouling. The time to clean your membranes are either just prior to a long-term shutdown, or as a matter deterioration of performance. Fouling characteristics that signal you need to clean are a 10-15% decrease in permeate flow, a 10-15% decrease in permeate quality, or a 10-15% increase in pressure drop as measured between the feed and concentrate flow.

RO cleaning frequency due to fouling will vary by site. A rough rule of thumb as to an acceptable cleaning frequency is once every 3 to 12 months. Having to clean your membranes more often indicates something in your feed water source that should be corrected through pretreatment. Under normal circumstances reverse osmosis membranes can last several years and with periodic cleaning it is possible to maintain the performance of the membranes. What you clean for can vary site by site depending on the foulant. Complicating the situation often is that more than one foulant can be present. Typical foulants are:

- Calcium carbonate scale
- Sulfate scale of calcium, barium or strontium
- Metal oxides of iron, manganese, aluminum, etc.
- Silica scale
- Colloidal deposits (inorganic or mixed inorganic/organic)
- Organic material of natural origin or man-made origin
- Biological (bioslime, mold, or fungi)

There are a number of factors involved in the selection of a suitable cleaning chemical (or chemicals) and proper cleaning protocol. The first time you have to perform a cleaning, it is recommended to contact the manufacturer of the equipment, the RO element manufacturer, or a RO specialty chemical supplier. Once the suspected foulant(s) are identified, one or more cleaning chemicals will be recommended. These chemical(s) can be generic and available from a number of suppliers.

Generally, in a Carwash environment a low pH cleaning is used first to remove foulants like mineral scale, followed by a high pH cleaning to remove organic material. Some cleaning solutions have detergents added to aid in the removal of heavy biological and organic debris, while others have a chelating agent like EDTA added to aid in the removal of colloidal material, organic and biological material, and sulfate scale. An important thing to remember is that the improper selection of a cleaning chemical or the sequence of chemical introduction can make the foulant worse and render the cleaning ineffective.

Membrane cleaning can be accomplished with the membranes left on the RO system inside their housings. Most carwashes use a RO system with less than 6 membranes in a single array. For carwashes with larger RO systems the design might have multiple arrays and each array should be cleaned separately. As mentioned, it would be best to use the instructions available from each membrane manufacturer, however a brief description of the process follows:

1. Mix (using RO permeate) the cleaning chemical in a tank per the chemical manufacturer's instructions. (MIX CLEANER TO OBTAIN 2-3 PH FOR LOW PH CLEANING AND 11-12 PH FOR HIGH PH CLEANING).
2. Connect hose from chemical tank to RO prior to the first membrane, and after the Feed pump. The tank should be hooked up to a pump that will be used to feed the chemicals into the membranes and re-circulate back into the tank.
3. Put the Permeate and Concentrate lines from the RO into the tank.
4. Turn on the re-circulation pump.
5. Adjust the CONCENTRATE CONTROL VALVE, until the CONCENTRATE PRESSURE GAUGE reads 50psi.
6. Re-circulate the cleaner for a minimum of 60 minutes.
7. Dispose of the solution and re-fill tank with clean RO water.
8. Disconnect the feed line from the tank to the RO and run the station to drain. This will rinse the Pump and the line. DO NOT RUN PUMP DRY.
9. Re-Plumb RO to normal state and run for 10 minutes, dumping the PERMEATE and CONCENTRATE to drain. This will ensure that all of the cleaner is flushed from the machine.
10. Put machine back online.

*****YOU MAY HAVE TO PERFORM A LOW AND A HIGH PH CLEANING TO UNFOUL THE MEMBRANES. FOR BEST RESULTS, START WITH A LOW PH CLEANING, THEN A HIGH PH CLEANING. RINSE WITH LOW PH FOR 5 MINUTES AND FLUSH WITH CLEAN WATER FOR 10 MINUTES*****

In conclusion replacing RO membranes can be expensive. With the proper pretreatment and a good maintenance schedule there is no reason not to expect several years on the life of the membranes. Cleaning your own membranes is relatively inexpensive and will help to keep the costs down on your spot free rinse solution.