Electrodialysis (ED) and **electrodialysis reversal (EDR)** use treated membranes that are semi-permeable to ions based on their charge. These processes utilize electrical current to reduce the ionic content of water. Two flat membranes, one that preferentially permeable to cat-ions and the other permeable to an-ions, are layered alternately, leaving flow channels between them. Cathode and anode electrodes are placed on each side of the alternating stack of membranes to attract most ions through the membranes. The result is a much lower ionic concentration in the water of the alternate channel.

Electrodialysis efficiency depends on the quality (e.g. dissolved solids level) of the feed water, temperature, flow rate, available area of the membrane, and the electrical current. Organic materials and weakly charged inorganic material are not well removed by ED. To improve the efficiency, the polarity of the electrodes may be reversed periodically. This process is called EDR, and has reduced both caling and fouling problems common to ED.

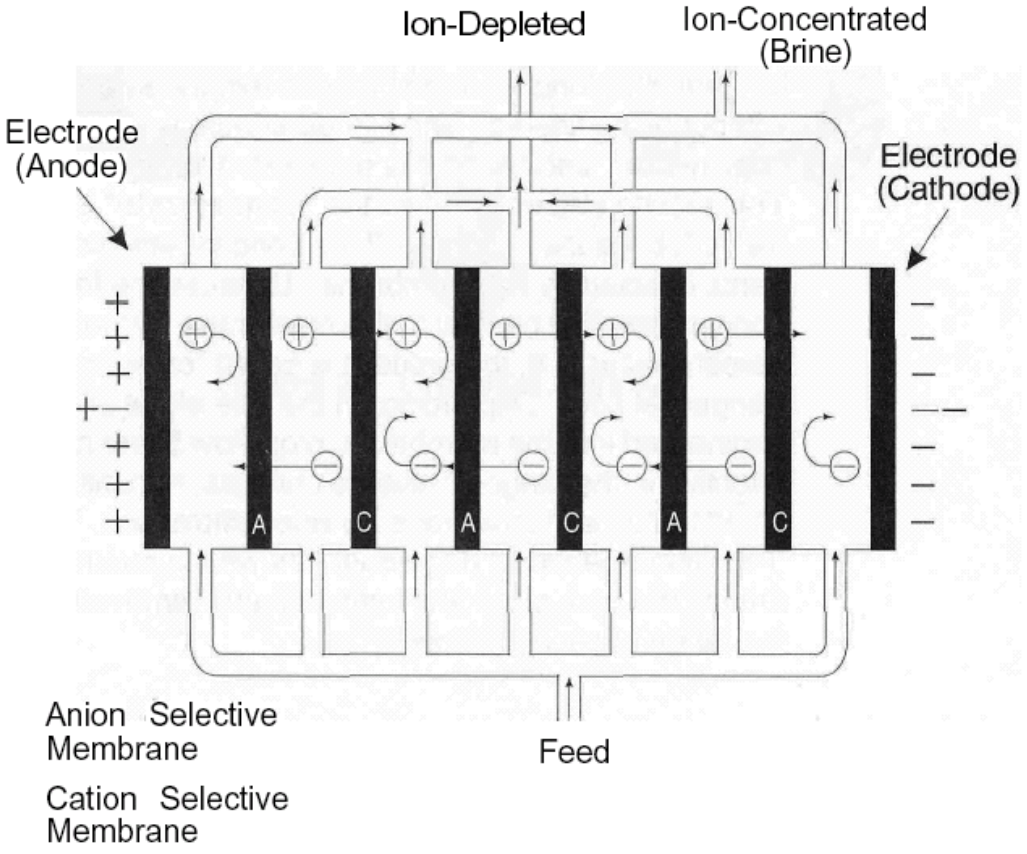

Figure **22 -** Electrodialysis Reversal (EDR) System
(Courtesy of Ontario Hydro)

Controlling microorganism colonies is important in maintaining the performance of all water systems, especially ultra-pure systems where bacterial fouling is the leading cause of contamination. Regularly monitored bacterial control equipment is a necessity.

Disinfection may occur on a continuous or a periodic (shock) basis. Continuous disinfection is preferable to keep bacterial populations from reestablishing themselves. Shock treatments are used when continuous biocide would be harmful to the end user. In shock treatment, the biocide and its by-products are flushed from the system prior to re-start.

Shock treatments generally remove a bacteria population but do not prevent it from recurring. Two important considerations when using biocides are 1) concentration and 2) dwell time. The higher the concentration, the shorter the dwell time needed for effective disinfection.

Other factors that affect biocide effectiveness are pH, temperature, water hardness, chemical compatibility and cleanliness issues. Most systems require cleaning before disinfection. Cleaning removes most surface bacterial film but they quickly re-establish themselves (see Disinfection).