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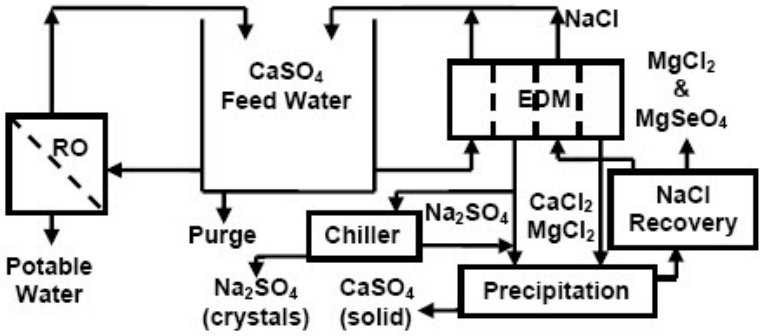
Desalting and Water Purification Research Program

Pilot Testing of Zero-Discharge Seawater Desalination – Application for Selenium Removal from irrigation Drainage

DWPR Report #135, T. Davis, Univ. of S. Carolina

Background:

The selenium level in irrigation drainage from the test site in the Panoche Water District is about 450 micrograms per liter (µg/L); whereas, the level allowed for irrigation or drinking water is 10 µg/L. Reverse osmosis (RO) is effective for removal of selenium, but yields of good water are less than 50 percent due to high levels of calcium sulfate ($CaSO_4$) leached from the soil. The zero-discharge desalination process tested in this project utilizes electrodialysis metathesis (EDM) to produce two concentrated streams—one rich in calcium chloride ($CaCl_2$), and the other rich in sodium sulfate (Na_2SO_4) (also containing all of the selenium, 4,700 µg/L). These two streams are mixed to precipitate calcium sulfate ($CaSO_4$). The salt-depleted solution from the EDM is returned to the RO unit to increase the yield of usable water. The supernatant from the precipitation can be processed by electrodialysis to recover sodium chloride (NaCl) for the EDM and produce a waste that is substantially concentrated in selenium.



Objective:

To operate the EDM process at steady state.

Conclusions:

EDM process was successful. Several improvements were identified to keep this complicated process running smoothly. They system was tested further at the Brackish Groundwater National Desalination Research Facility in Alamogordo, NM.