

Disposal of Desalting By-Product

To date, the drinking water industry has primarily focused on the use and management of freshwater supplies to meet demands. However, in several regions of the U.S., these supplies have been utilized and managed to their full capacity. Purveyors of potable water are now turning to supplies of lesser quality. These include brackish groundwater, brackish surface water, and seawater. Treatment of these waters for potable use requires membrane desalting technologies such as reverse osmosis (RO) and electro dialysis reversal (EDR).

RO and EDR are used in some capacity across the US and more heavily in the states of California, Florida, and Texas. These and other states have recently received heightened attention from the desalting industry due to increased emphasis on the use of seawater as a potable water supply. One impediment to the growing demand for membrane desalting technologies is the disposal of resulting by-products.

Desalination water treatment plants (DWTPs) produce by-product as they separate salts, minerals, and other dissolved constituents from the water. The separation of these constituents results in two flow streams: 1) a purified potable stream (permeate), and 2) a stream containing the separated dissolved constituents. The latter by-product stream is typically referred to by regulators as "concentrate" and sometimes inappropriately referred to as "brine".¹

By-Product Disposal Alternatives

Desalting by-product is commonly disposed of through one of six practices: 1) sewer discharge, 2) surface water discharge, 3) irrigation, 4) deep well injection 5) evaporation ponds, 6) zero



liquid discharge thermal processes. Each of these methods varies in complexity of permitting and costs, with sewer discharge commonly being the least complex and least costly and zero liquid discharge being the most complex and most costly.

Sewer Discharge is dependent on the ability of the wastewater treatment plant to accept high salinity discharge both in terms of capacity as well as water quality. The treatment plant outfall location may be affected by total dissolved solids restrictions or other limiting water quality concerns. A national pollution discharge elimination system (NPDES) permit is required and maintained by the WWTP owner.

Surface Water Discharge involves discharge to a point of outfall such as a bay, tidal lake, brackish canal, or ocean. The location and potential required by-product treatment prior to discharge are determined by state and regulatory agency water quality standards and bioassay toxicity testing. An NPDES

permit is required and maintained by the DWTP owner.

Irrigation is sometimes used for by-product streams relatively lower in salinity. Saline tolerant vegetation and habitat are required. This is usually determined by site-specific soil and drainage characteristics. An NPDES permit is required and maintained by the DWTP owner if run-off from irrigation is possible.

Deep Well Injection is very common, especially with inland DWTPs. This method injects the by-product stream deep below ground under at least one overlying, confining geologic layer. The by-product is permanently stored in the injection zone.

Evaporation Ponds may be used to reduce or eliminate by-product flows. This method of disposal is land-intensive and requires relatively dry climates. Dry salt is the waste product, and it must be characterized and disposed of accordingly as solid waste.

Zero Liquid Discharge Thermal Processes greatly reduce or eliminate the by-product liquid stream through thermal treatment processes. These processes are energy intensive and are very costly. Wastes must be characterized and disposed of accordingly.

Is Desalting By-Product from Drinking Water Production An Industrial Waste?

The answer to this question involves the synergy between the applications for membrane desalting and federal and state agencies responsible for developing laws and issuing National Pollution Discharge Elimination System (NPDES) permits.

At present, the Clean Water Act does not specifically address DWTP by-products. As a result, DWTP by-products are addressed through a default classification: industrial waste. This results in a stringent and cumbersome set of regulations applied to an often benign by-product primarily composed of constituents from a natural water body, albeit in a form that is more concentrated. Furthermore, the term “industrial waste” is alarming to the public. Often, purveyors of potable water are required to spend excessive amounts of finance and efforts educating the public about the benign nature of this by-product. This expense transfers into higher water costs for the treatment process.

The absence of science-based regulations to address DWTP by-products has resulted in an uncertain regulatory environment. The latitude available to regulatory agencies when addressing the default classification of “industrial waste” greatly limits the ability to predict the outcome of any permitting effort and further limits the ability to accurately forecast costs, suitability, environmental compatibility, and other key planning level tasks. Of particular concern are the use of surface water discharge and the issuance of an NPDES permit. Because desalting by-product is inadequately addressed in NPDES law, surface water discharge is

often the most problematic yet most applicable method of discharge for larger DWTPs, which are necessary to meet water deficits.

At present, state regulatory agencies have no choice but to address DWTP by-products through industrial waste regulations. These agencies would benefit from more specific regulatory guidance regarding desalting by-product.

Florida Case Study

The State of Florida recently passed legislation to streamline the permitting process for desalting by-product waters. Though incapable of amending the Clean Water Act to reclassify the by-product out of the industrial waste program, the state was able to change the name and create permitting forms that are better suited for by-product applications.

Florida now refers to “RO concentrate” as a “potable water treatment by-product,” which is still regulated under the industrial program as required by the Clean Water Act. However, the law’s objective is to improve the economics of permitting desalting by-product discharge to surface waters by improving public perception and creating permit applications and permits that are best suited for this type of by-product.

¹Brine is water with twice the concentration of dissolved solids as seawater. Most desalting by-products do not fit this definition. The word “brine” carries a negative connotation since it is also used to refer to some wastes from the petroleum industry.

Nevertheless, a strong case can and should be made to amend the Clean Water Act to provide for a new, separate classification for DWTP streams and how to deal with them.

AMTA is actively involved in the legislation front and has made the change in regulations of concentrate disposal a top priority for the organization.

This material has been prepared as an educational tool by the American Membrane Technology Association (AMTA). It is designed for dissemination to the public to further the understanding of the contribution that membrane water treatment technologies can make toward improving the quality of water supplies in the US and throughout the world.

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