KEY POINT: *Ocean discharge is often only feasible for coastal brackish water desal plants where access to the ocean is relatively easy.*

**SUMMARY OF ISSUES**

- Disposal to surface water involves conveyance of the concentrate or backwash to the site of disposal, and an outfall structure that typically involves a diffuser and outlet ports or valves mounted on the diffuser pipe.

- Surface water discharge to the ocean can be a low-technology, relatively inexpensive disposal option for inland facilities particularly where the terrain allows for gravity flow to the ocean. The most common example of this is the brine lines in California which convey concentrate from multiple inland facilities either directly to the ocean or to a coastal wastewater treatment plant which discharges to the ocean. Very few other desal plants currently utilize this option.

- The feasibility of ocean discharge depends on the distance of the desal plant to the ocean discharge outfall, the conveyance cost of transporting concentrate, and the cost of building new ocean outfalls.

- In addition to direct ocean discharge, inland facilities can discharge concentrate to nearby rivers or canals that lead to the ocean or sea, if they are available.

- Because the salinity in brackish water concentrate is often lower than seawater, salinity increase beyond the tolerance thresholds of the surrounding discharge environment is less a concern for brackish water discharge. However, there are several environmental impacts associated with disposal of brackish water concentrate that should be considered (see related PIM cell discussion on environmental impacts associated with disposal of inland concentrate to the ocean).

**STRATEGIES**

- Desal plants may explore the feasibility of a cost-sharing project with other industries or communities for construction of a pipeline system to convey desal concentrate to the ocean.
The planning and design of ocean discharge of brackish water concentrate should consider compatibility of the concentrate with receiving waters and the conveyance system. Key considerations include:

- Harmful concentration of metals and radioactive ions in the concentrate
- Concentration and discharge of nutrients that trigger change in aquatic flora and fauna in the area of the discharge
- Ion-imbalance driven toxicity
- Low oxygen concentration in the brackish water concentrate, in particular when groundwater is used as the source water for the desal process.

To minimize negative environmental impacts, ocean disposal must be carefully designed. Some key considerations include:

- Hydraulic modeling to assess whether the discharge water quality meets effluent water quality standards applicable to the concentrate discharge
- Well designed outfalls to ensure sufficient mixing and dilution
- Long-term monitoring the ecological environmental in the surrounding area of the outfall
- Post-treatment of the concentrate to reduce contaminants and/or to eliminate sources of toxicity.

BENEFITS & COSTS

Benefits

When the access to ocean is feasible and cost-effective, ocean discharge can be a viable option for concentrate management at inland desal facilities.

Costs

For inland and coastal brackish water facilities where terrain allows for gravity flow to the ocean, ocean disposal is the most common and frequently the least expensive option. The costs for ocean discharge at inland desal plants are site specific, and mainly determined by (Mickley 2006):
Concentrate conveyance costs from the desal membrane plant to the ocean discharge outfall. These costs are typically closely related to the concentrate volume and the distance between the desal membrane plant and the discharge outfall.

Costs for outfall construction and operation. These costs depend on the outfall size, diffuser system configuration, outfall length and material, and concentrate treatment prior to discharge.

Costs associated with monitoring environmental effects of concentrate discharge to surface waters. The costs associated with environmental monitoring of surface water discharge may be substantial, especially if the discharge is in an environmentally sensitive area, or in areas with limited natural flushing.

**KEY UNCERTAINTIES**

Ocean disposal can be impacted or inhibited by new legislations on ocean outfalls. For instance, during the 2008 session, the Florida Legislature passed laws that will result in the elimination of the six ocean outfalls that are currently used for effluent disposal. This legislation requires the utilities that currently utilize ocean outfalls as a wastewater disposal method to (Xu et al. 2009):

- Go to advanced wastewater treatment by 2018;
- Eliminate the discharges by 2025, except for wet weather; and
- Achieve, at a minimum, 60 percent reuse of the facility’s actual annual flow by December 31, 2025.

**ADDITIONAL RESOURCES**


