KEY POINT: *Public concern regarding environmental and public health issues can block implementation of desal projects.*

SUMMARY OF ISSUES

- Successful implementation of a desal plant requires more than a successful resolution of technical issues. Affected persons and stakeholders are often able to slow or block implementation if public perception is negative, whether or not a concern is justified in the particular project (NRC 2008).
- In relation to environmental and public health issues, public concerns about desal include worries related to:
  - Cleanliness of the source and product water,
  - Energy intensity and GHG-emissions
  - Environmental effects of source water intake (for surface water sources) and concentrate management
  - Siting issues
  - Necessity of supply (growth inducement)
- Perceptions and concerns about desal may be influenced by the need or urgency for an additional source of freshwater or for a reliable source of water.
- Broad-based public participation in the planning process—that is, greater than that necessitated by permitting requirements—may help minimize adverse relationships and help the project progress more readily toward successful implementation (NRC 2008 from Burroughs, 1999; Roberts, 2004; Robinson, 2007).

Source Water Issues

Desal utilizes source water not previously considered suitable as a source for drinking water. For example, seawater contains much higher concentrations of many chemical species than are found in conventional drinking water supply sources or finished waters. Inland brackish waters can be perceived as being less pristine than other groundwater. Concerns may arise among the public over the ability of the desal process to fully treat these source waters (NRC 2008).

In addition, there can be public health and associated regulatory compliance issues that arise when desalted water is blended with other utility waters in the post-treatment and distributional phases of the desalting systems process. These concerns include the potential for desal to alter the level and/or mix of disinfection byproducts (DBPs) produced when potable waters are disinfected with chlorine or other disinfectants. The presence of low levels of bromide in desalted seawater may, for example, lead to the formation of more brominated DBPs, and these could imply higher health risks in tap water than a community faces currently.

Energy and GHG emissions

Although less of a concern for brackish water desal, current desal technologies are very energy intensive. This contributes to the high cost of desal compared to most other water supply options.

Energy intensity raises more than just cost concerns. In many regions, there are concerns that the energy demands associated with desal will affect the reliability and sustainability of the overall power grid system (especially as water demands tend to peak at the same times as energy demands, for example, on hot summer days). This is particularly true in areas where grid capacity is already strained by current demands (as in California). Thus, the concern is that the broader application of desal could push the electrical transmission grid, and the region's power generating capacity, into heightened vulnerability to blackouts and other failures (Stratus Consulting 2006).

There is also concern among some stakeholders regarding greenhouse gas (GHG) emissions – and air pollution emissions in general – associated with the need to expand fossil fuel use to power desal facilities. GHG emissions are linked with global climate change, and other air pollutants pose risks to human health, vegetation and other resources, and/or impair visibility. The link between the energy needs for desal and increased air pollutant emissions and global warming creates another basis for concern about (and for some people, opposition to) desal (Stratus Consulting 2006).

One avenue to address this concern is to explore alternative (renewable) energy options for desal facilities (and/or for water agencies in general). Renewable energy has been pursued to power the majority of the large-scale desal plants in Australia and UK. Although generally valued by the public, the costs associated with renewable energy to support desal can be significant (and can actually increase overall desal costs). Exploitation of renewable energy and development of desal plants typically requires intensive capital investments. There are also limitations related to the temporal and spatial dependency of renewable resources (including associated high land requirements) (Mathioulakis, Belessiotis and Delyannis 2007).

Impacts of desal process components

Among several environmental concerns related to desal (including the energy-related environmental concerns noted above), two in particular garner significant attention. The first pertains to impingement and entrainment (I&E) of aquatic species due the use of open water intakes to draw feedwater. This concern is considerably less relevant for inland brackish water desal facilities, which typically utilize groundwater as the source water for desal processes. However, I&E can be an issue for inland facilities drawing water from surface water sources.

In many cases, the adverse effects of I&E can be avoided or minimized through appropriate location selection, operational flexibility and improved technologies (Xu et. al. 2009). Key questions include how well alternative feedwater intake design and operating options, such as intake screening options and velocity parameters, minimize I&E. There are also key questions about the viability and long-term performance (across different settings) of beach wells and other subsurface alternatives to open water intakes.

The second major environmental concern associated with desal pertains to the management (reuse or disposal) of desal concentrate, the by-product of the membrane process. Coastal desal plants are often able to safely dispose of desal concentrate (via direct discharge into the ocean or estuaries) at relatively modest costs. However, concentrate management is currently one of the most challenging issues associated with desal in an inland setting. Although there are five conventional disposal methods that account for the vast majority of municipal desal plants, rarely are more than one or two available at a given location. Each method has its own set of site-specific costs, regulatory requirements, and environmental challenges.

Although several disposal methods are available, each method has its own set of site-specific costs, regulatory requirements, and environmental challenges.

Current options for concentrate disposal at inland facilities include surface water discharge, including brine lines that carry the concentrate to a coastal location (where it typically is blended with a much larger volume of municipal wastewater, and discharged to the ocean or directly discharged to the ocean), discharge to an existing sewer system, deep well injection (pumping the wastes into deep, unusable, and hydrologically isolated aquifer systems), land application (irrigation) and evaporation ponds (which are often not viable due to the land area required and the concerns associated with wind-blown dispersal of hazardous salt compounds or potential leaching leading to groundwater contamination).

All of these inland options are of limited applicability, depending on concentrate quality and quantity, physical location (e.g., close enough to the coast for a brine line, close to a suitable recieving water), general climate (suitable for year-round evaporation ponds and land application), hydro-geologic conditions (e.g., proximity to a suitable deep well injection site), and numerous regulatory constraints related to potential impacts on the receiving water or soil. As a result, it is becoming more and more challenging to find a technically, environmentally, and financially viable method of dealing with the concentrate from inland facilities.

Innovations that can help reduce the toxicity of brine concentrates, or that offer safe ways of reusing or disposing of these wastes, will be highly valuable to the desalting community (and probably quite rewarding for the inventors) (Stratus Consulting 2006).

Localized Siting Concerns

Public perception can be focused on highly localized issues associated with the siting of desal facilities. Localized environmental degradation, barriers to beach access, and increased population growth and regional development are examples of concerns voiced by citizens. Although some of these issues would arise with any development in these areas, there are certainly unique siting concerns associated with desal. For example, it was found in Tampa Bay, Florida, that consumer interest, positive or negative, was not strong regarding the desal project until specific potential sites were chosen. In Tampa, some of the negative public reactions derived from the plan to co-locate the plant with an existing coal-burning power plant, reflecting citizens' displeasure with the possibility of prolonging the operational life of the power plant. The public also expressed concerns about environmental impacts on Tampa Bay (NRC 2008 from Robinson 2007).

Necessity of Supply

Proposals for a new desal plant can lead the public to question the need for additional water supply. If current water supplies are sufficient to meet demands, desal may be seen as unnecessary, even if it would replace an unsustainable water source currently in use or would allow for currently unmet environmental water needs to be fulfilled.

In addition, stakeholders may be concerned about the growth implications associated with desal as a new water supply option or may not feel that alternative options, such as water conservation and recycling, have been fully explored.

The growth implications of new water can be controversial. Some communities desire to limit growth and view additional water supply as a threat to no- or slow-growth preferences. They generally oppose the availability of new water sources that could open the door to unwanted or uncontrolled growth. Desal resulting in "new" water supplies therefore could be considered a threat to these communities or regions (CDWR 2008).

On the other hand, many communities (particularly in the Western U.S.) have limited water supplies, as well as limited options for "new" water. For areas experiencing or desiring the ability to support population growth, new development, or facing new housing requirements, the need for new water sources can become critical. Some communities have not been able to meet existing demand for several years as gradual growth has exceeded existing supplies of high quality potable water.

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STRATEGIES

Public involvement and education

Water resources planning is a challenging public policy issue. Most "new" water supplies being considered today, perhaps with the exception of conservation, receive intense public scrutiny. In the absence of effective approaches to educate and involve the public, elected officials and even some regulatory agencies, the recipe exists for significant resistance to new water projects (CDWR 1008). The lack of an effective public involvement program has already proved to be an impediment to developing several coastal desal facilities. These impediments, however, can often be resolved by adequate planning and a genuine public engagement program.

Engage stakeholders early in the planning process

Engaging key stakeholders and the broader public early in the process of developing a desal project is key. It is important to have the proposed project sufficiently developed so it can be accurately described, yet not so far along as to suggest that it is "set in stone." Effective public involvement rests not only on early involvement but also in creating an open and transparent process that allows meaningful public input on issues of environmental, economic and community importance.

Evaluate desal as part of broader water supply portfolio

To address concerns regarding the necessity of supply, water suppliers must consider desal as part of a broader regional water supply portfolio. As noted above, it is generally recognized that water conservation be maximized prior to or as part of a larger strategy that might employ desal, or other more energy intensive options. When low-cost demand management techniques (such as conservation and market-like transfers) have not been exhausted and, so long as potential remains, demand management will offer the possibility of freeing up water to serve new uses at lower cost than desal.

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BENEFITS & COSTS

Although public involvement programs require time and money, they can effectively mitigate future costs associated with public opposition and/or even litigation.

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KEY UNCERTAINTIES

Public concerns will vary by project and significant issues cannot always be anticipated by the water supplier. Water suppliers must be careful not to develop the project too far before involving the public. This allows room to address unanticipated concerns and issues.

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ADDITIONAL RESOURCES

Burroughs, R. 1999. When stakeholders choose: Process, knowledge, and motivation in water quality decision. Society and Natural Resources 12(8):797-809.

CDWR (California Department of Water Resources). 2008. *California Desalination Planning Handbook.* Resources. Prepared by: California State University, Sacramento Center for Collaborative Policy. Available: <http://www.owue.water.ca.gov/recycle/docs/Desal_Handbook.pdf>.

Mathioulakis, E., V. Belessiotis, and E. Delyannis. 2007. Desalination by using alternative energy: review and state-of-the-art. *Desalination*, 203:346-365.

NRC (National Research Council). 2008. *Desalination: A National Perspective*. Washington, D.C.: National Academy Press. Available: <http://www.nap.edu/catalog/12184.html>.

Roberts, N. 2004. Public deliberation in an age of direct citizen participation. American Review of Public Administration 34(4):315-353.

Robinson, M. K. 2007. Communications Lessons from the Frontline of Desalination Plant Development. Presentation given to the NRC Committee on Advancing Desalination Technology, Clearwater, FL.

Stratus Consulting. 2006. Institutional Issues in Desalination and Water Purification Technologies, Final Report. Prepared for Joint Water Reuse and Desalination Task Force, AWWA Research Foundation, Sandia National Laboratory, U.S. Bureau of Reclamation, WaterReuse Foundation. Boulder, CO: Stratus Consulting Inc.

Xu, P., T. Cath, G. Wang, J.E. Drewes and S. Dolnicar. 2009. *Critical Assessment of Implementing Desalination Technology*. Denver, Colorado: Water Research Foundation

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