Open Ocean Intake Desalination: Impacts & Alternatives

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Three Points About Open Ocean Intake Desalination

1. No current way to avoid harmful environmental impacts
2. Costs are still higher than other options and there are still significant financial risks
3. There are more cost-effective, environmentally sound alternatives, conservation & recycling, etc.

What We Know About Open Ocean Desalination

- State agencies have done reports
- Studies of intakes
- Look at actual desalination plant experience in Tampa Bay

Environmental Impacts

- **Impingement** is the term for the mortality of larger animals that are trapped and killed on the intake screens

- **Entrainment** refers to smaller organisms (e.g., larvae and eggs) that slip through the screens and are killed once they enter either the membranes of the desalination plant or the cooling condensers of an electric generating plant

Open Ocean Intake
Entrainment & Impingement Impacts

- Most regulators assume 100 percent mortality for organisms entrained*
- There are currently no methods of screening out small fish and larvae
- Results of a study of impingement at Morro Bay conducted from 1999 to 2000, reported a yearly rate of impingement of 55,000 invertebrate individuals and 78,000 fish.*

***Dr. Pete Raimondi, Professor and Chair, Dept of Ecology and Evolutionary Biology, UC Santa Cruz**
"Estimation of ecological impacts due to use of seawater in a desalinization facility (in a NEPA / CEQA context) Impingement, Entrainment."

Co-location of Desalination with Power Plants

"Cooling water intake structures cause adverse environmental impact by pulling large numbers of fish and shellfish or their eggs into a power plant's or factory's cooling system. There, the organisms may be killed or injured by heat, physical stress, or by chemicals used to clean the cooling system. Larger organisms may be killed or injured when they are trapped against screens at the front of an intake structure."

-US EPA

Comparison of estimated entrainment impacts at four coastal powerplants

Site	Intake	Estimated larval loss	Population at risk	Area of production forgone
Moss Landing	In harbor	13-28%	Elkhorn Slough (3000 acres)	390-840 acres
Morro Bay	In Morro Bay	17-32%	Morro Bay (2000 acres)	340-640 acres
Diablo Canyon	In Diablo Cove	4-24%	Coast of California	5-50 km of coastline
SONGS	6000-8000 ft offshore	3-13%	Southern CA Bight	3-13% of S.Cal Bight

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Co-location of Desalination with Power Plants

- Co-locating desalination plants with cooling water intakes does not address the environmental impacts, and may result in continued use of these harmful intakes

- EPA is developing regulations under section §316(b) of the Clean Water Act, requiring that the location, design, construction and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact

Other Potential Coastal Zone Impacts

- Air quality
- Commercial and recreational fishing
- Construction impacts on land and marine species and habitats
- Energy use
- Growth-inducing effects
- Marine resources impacts from ocean discharge
- Navigation
- Noise
- Potential hazardous releases from accidents
- Public access
- Recreation
- Visual quality
- Water quality
- Water quantity (e.g., effects of drawdown or saltwater intrusion of groundwater wells)
- Cumulative impacts

-California Coastal Commission, “Seawater Desalination in California”

Some Legal Requirements

- Coastal Act Section 30230 provides:

  "Marine Resources shall be maintained, enhanced, and where feasible restored…" "…Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes."

- Coastal Act Sections Section 30231 states in part:

  "The biological productivity and the quality of coastal waters,… …appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment...."

Energy Use

- Section 30253(4) of the Coastal Act requires that new development minimize energy consumption

- Current systems using reverse osmosis technology require about 30 % more energy than existing interbasin supply systems - California Desalination Task Force

- Energy use is on the order of **3,260 to 4,900 kWh** of per af - California Desalination Taskforce

Costs & Subsidies

- The cost for new seawater and estuarine water desalination will range from $700 to $1,200 per af plus distribution costs- California Desalination Task Force
- These figures are based on subsidized energy costs of $0.05 per kWh. Under current requirements and market conditions, energy costs are in the range of $0.08 to $0.13 kWh, so the production costs noted above should be adjusted upward by $150 to $350 per acre-foot.
- Therefore costs are likely to be well over $1000 per acre-foot

The Tampa Bay Example

- Tampa Bay Desalination Expectations
  - Designed to produce 25 million gallons of water per day (mgd)
  - Costs estimated at about $815 per acre foot
  - Largest desalination plant in the United States
  - Project began in 1997, expected to operate in 2003

Tampa Bay Desalination Realities

- May, 2003 Desalination plant fail to pass performance test
- Test revealed 31 deficiencies in the plant
- October, 2003 again failed to meet performance standards, 16 deficiencies still not fixed

Unexpected filtration problem…

Tiny Asian green mussels, attracted to high nutrient intake water clogged filters at the plant in 2003

Current Status at Tampa Bay

- Plant still does not meet contractual process and design standards, adding to operating costs, requiring more energy, more chemicals and more frequent filter replacements.

- “The plant is simply not as efficient as it should be.”-Tampa Bay Water

Current Status at Tampa Bay

- Three bankruptcies, at least three lawsuits
- Plant is now in standby mode, operated for only one week per month
- Still in need of at least $24 million in repairs

Alternatives to Open Ocean Desalination

- Water Conservation (Urban and Ag)
  - Costs are low, reduces runoff, saves energy
- Water Recycling
  - Lower energy use, lower cost, reliable in droughts
- Groundwater Treatment and Desalination
  - Not as harmful to the environment, lower salinity results in lower costs

Do We Need Open Ocean Desalination?

Additional Need	Million acre feet
Additional Population (12 million by 2030)	2.0-2.4
Environmental Restoration	1.0
Total Additional Need	3.0-3.4

Do We Need Open Ocean Desalination?

Management Options	Potential yield (maf)
Urban Water Conservation	2.0-2.3
Agricultural Water Conservation	0.3-0.6
Water Recycling	1.5
Groundwater Desalination	0.29
Total Potential	4.09-4.89

Do We Need Open Ocean Desalination?

Needs vs. Potential Yield	Million acre feet
Additional Needs	3.0-3.4
Yield from priority management options	4.09-4.89
Resulting Balance	+1.09-1.49 maf

Final Points

- Desalination is risky, cost savings and water supplies have not been realized
- Environmental issues will not go away, must be addressed by technology and research
- There are other, viable, more environmentally sound, reliable and cost-effective alternatives to open ocean desalination

What you need to do

1. Fully implement conservation, recycling and groundwater desalination

2. Make proponents fully disclose all environmental impacts

3. Get independent financial risk assessment

Useful References

- California Desalination Task Force
  - http://www.owue.water.ca.gov/recycle/desal/desal.cfm
- California Coastal Commission
  - http://www.coastal.ca.gov/
- Tampa Bay Water
  - http://www.tampabaywater.org/
- Planning & Conservation League
  - www.pcl.org