SANTA CRUZ NEIGHBORS

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Introduction

• I will focus my comments on the ocean issues related to desalination. Understandably, with any significant change from the past, there will be concerns, issues, uncertainties and the potential for polarized or opposing views.

• We need to look carefully and critically at previous history of other projects, the information and data from prior studies, and the process needs to be open and transparent.

• Also need to keep in mind that there are a number of existing intakes and outfalls from very large power plants, sewage treatment plants, that have been in existence for decades, so we have considerable experience and observations of impacts.

• Desalination, like any other industrial process, has environmental impacts that we need to understand and reduce or mitigate to the degree possible.

• The **two major potential ocean impacts** to consider are those associated with **removing** the water from the ocean and with **returning the brine** to the ocean.

IMPACTS OF WATER INTAKES- IMPINGEMENT AND ENTRAINMENT

In addition to the seawater itself, the water that is pumped from the surface waters of the ocean contains a range of organisms from the very large: **marine mammals, to fish**, as well as **plankton** of various types (plankton such as krill, or **eggs or larvae** of larger organisms, such as fish or shellfish.

This animal life can be killed on the intake screens or filters (***IMPINGEMENT***), or for the plankton that is small enough to pass

through the screens, killed during the processing of the seawater (***ENTRAINMENT***).

The **magnitude of these effects** is dependent upon several factors, including:

- **volume** of water withdrawn
- the **source** of the water and therefore the number of organisms or plankton of different types
- the **mortality rate** compared to natural mortality or standing stock of the organism type. Only small % of all larvae survive their planktonic existence (codfish 4-6 million eggs laid).

• In recent studies, the impingement and entrainment issues have usually been considered as the largest single ecological barrier to desal plant siting. Comparisons have been drawn between the potential effects of desal plant intakes and power plant cooling water intakes, which have been operating for many years with much higher intake volumes, which is an important perspective:

Moss Landing Power Plant 1 billion gpd/
SCMD[2] 5 mgd or 0.5% of Moss Landing

Loss of planktonic larvae at large coastal power plants in California through entrainment has been estimated at 4 sites: Moss Landing, Morro Bay, Diablo Canyon and San Onofre.

Moss Landing estimated at 13-28% larval loss over area of 390-480 acres. **SCMD[2]** is 0.5% of ML volume, which would translate to less than 1% of the ML impacts.

Another comparison can be made with *this volume and the offshore volume:*
Monterey Bay has about 18 miles^3 of seawater or 20 trillion gallons.
If there was no mixing it would take about 11,000 years to pass through 5 mgd, .. but there is mixing and our study of coastal currents allows us to know how much mixing and current dispersal would take place.

***Reducing Impingement and entrainment*:**

1. ***Subsurface intake wells*** on the beach or buried on the seafloor use sand as extra filter, that could greatly reduce the update or entrapment of marine life- originally believed to be a better alternative, they require a coarse sand or gravel substrate, they can limit pumping volumes, can interfere with freshwater aquifers, but most have suffered from clogging and collapse, and now understood to be problematic because of larvae in sand.
2. ***Deeper water intakes***, thereby avoiding much of the plankton and marine life. Water is cleaner, less turbid, more uniform in quality, and most of plankton is above 30 to 40 meters depth.
3. ***Using a number of separate intake ports or inlets*** can reduce the intake velocity at the points, thereby allowing larger organisms to avoid or swim away from intakes.

IMPACTS OF WATER DISCHARGE

After passing through **reverse osmosis process** about ½ of the water is now fresh or distilled and ½ is now twice as salty as the original seawater and discharged offshore.

Normal seawater is 3.5% by weight salt, so what is called "***brine***" is about 7% salt by weight, therefore slightly more dense. *Salt composition* does not change, just its *concentration* (Cl 55%, Na 30.6%, SO4 7.7%, Mg 3.7%, Ca 1.2%, K 1.1% = 99.3% 6 most important constituents). Its what sticks on your skin when you get out of the water, or what you sprinkle on your food.

This ***brine*** is often combined with treated wastewater (SC has a outfall discharging about 10-12 mgd about 2 miles offshore) to even out salinity or density, or can be combined with power plant cooling water discharge.

Any **chemicals used in the desalination process may also be discharged with the brine.** Most of these are chemicals applied during the pretreatment process to prevent fouling or clogging of the membranes.

Chlorine or other disinfectants can be applied to keep organisms from growing on the filters, pipes, etc. Because chlorine can damage the membranes, sodium bisulfite is often added to eliminate the chlorine.

Sewage treatment also adds chlorine to disinfect treated wastewater before ocean discharge. Chloride is also second most abundant ion in seawater.

Anti-scalants to prevent salt buildup, **coagulants** to help flocculate particles, various **rinses or other cleaning processes** and chemicals may be involved in process.

Taking in the highest quality of water to begin with reduces the need or demand for these treatment processes and chemicals, and subsequent discharge with the brine.

Filtration throughout the process can reduce discharge and need for treatment.

BRINE DISCHARGE-

Ocean discharge is most common disposal method for coastal desalination plants. Brine can be pure, mixed with treated wastewater or combined with power plant cooling water.

The **assumption** is that the ocean discharge will be **diluted** with much larger volumes of ocean water, the same as the assumption for treated wastewater, thus reducing any environmental impacts.

Certainly with the major constituent, the 2X normal salt content, dilution is going to happen. Because the brine is denser, if undiluted, it will flow towards the seafloor. Local conditions, water depth, ocean currents, wave mixing, sea floor turbulence will all affect the rate of dilution.

The effects of any other residual chemicals will depend upon their concentration, their possible toxicity, the dilution factor and the organisms present in the discharge area.

Dispersing the effluent through a series of diffusers, such as usually done with any ocean water discharge, is one straightforward way to dilute the brine more quickly and spread it our over a larger areas.

Siting the outfall where turbulence, from waves, currents, water depth are optimal, where marine life is minimal is another approach to reduce potential impacts.

Combining brine with treated wastewater or cooling water is another mechanism for dilution. SC has average treated wastewater flow of 10mgd to dilute 2.5 mgd.

Desalination has been practices for decades, there is a lot of information and data that has been collected, lots of intakes and discharges to learn from. This shouldn't be an unknown or mystery.