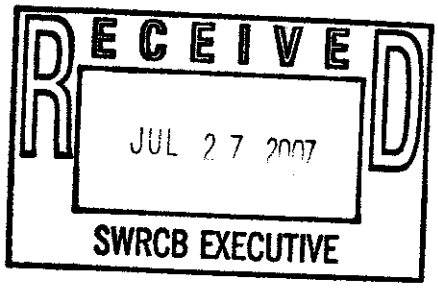
POSEIDON RESOURCES

6/26/07 Scoping Mtg.
CA Ocean Plan Amend.
Deadline: 7/27/07 Noon

July 26, 2007



Song Her
Clerk to the Board, Executive Office
State Regional Water Quality Control Board
1001 I Street
Sacramento, CA 95814

Dear Song Her,

Thank you for the opportunity to comment on the June 2007 Amendment of the Water Quality Control Plan - Ocean Waters of California. Enclosed are Poseidon Resources Corporation's comments on Issue 10: Desalination Facilities and Brine Disposal. If you have any questions please feel free to contact me at (619) 595-7802.

Sincerely,

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Senior Vice President

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Poseidon Resources Corporation

COMMENTS TO

SCOPING DOCUMENT
AMENDMENT OF THE WATER QUALITY CONTROL PLAN

OCEAN WATERS OF CALIFORNIA

June 2007

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

Issue 10: DESALINATION FACILITIES AND BRINE DISPOSAL

BOARD'S PRELIMINARY ALTERNAITVES

Staff proposed the following three alternatives to regulate brine waste discharges form desalination plants or groundwater desalination facilities:

1. No Action. Do not change the existing Ocean Plan;
2. Establish a narrative water quality objective where salinity should not exceed a certain percentage of natural background.
3. Establish a numeric water quality objective.

POSEIDON RESOURCES RECOMMEDATION

Poseidon Resources recommends Alternative 1 – No Action – Do not change the existing Ocean Plan - for the following key reasons:

1. The existing 2005 Ocean Plan already has provisions to regulate the salinity level of the desalination plant concentrate (brine waste) discharges via the existing Acute and Chronic Toxicity objectives. If a given desalination plant discharge meets all water quality objectives defined in the Ocean Plan, including Plan's acute and chronic toxicity objectives, than this discharge does not present a treat for aquatic life regardless of what the actual salinity level of this discharge is or what increase above ambient salinity this discharge causes.

2. Salinity tolerance of aquatic life is site specific and depends on the organisms inhabiting the area of the discharge, the nature of the discharge (brackish or seawater concentrate (brine)), or a blend of these discharges with another waste stream, such as wastewater treatment plant effluent, or power plant cooling water), as well as on the length of time of exposure of the marine organisms to the elevated salinity conditions (see Attachment 1). Therefore, a single, non-site specific "blanket" narrative or numeric water quality objective for salinity will not

provide additional protection of the site specific marine environment in the area of a given discharge, beyond that already provided by the Acute and Chronic Toxicity objectives.

3. The existing 2005 California Ocean Plan and policies of the State Water Resources Control Board already have provisions that allow the Regional Water Quality Control Boards (Regional Boards) to introduce site-specific water quality objectives or numeric limits for any water quality parameter, (salinity not excluded), if found necessary for the site-specific conditions of a given waste discharge. Recent examples of such Regional Board actions are the NPDES Permit for the 50 MGD Carlsbad Seawater Desalination Project (NPDES No. CA0109223/ORDER No. R-9-2006-0065) adopted by the San Diego Regional Water Quality Control Board (Region 9) on August 16, 2006 (see Attachment 2); and the NPDES Permit for the 50 MGD Huntington Seawater Desalination Project (NPDES No. CA8000403/ORDER No. R-8-2006-0034) adopted by the Santa Ana Regional Water Quality Control Board (Region 8) on August 25, 2006 (see Attachment 3). The Carlsbad Project NPDES permit contains an Effluent Limitation for Chronic Toxicity at the edge of the zone of initial dilution in combination with numeric limitations for average daily and average hourly total dissolved solids (salinity) concentrations of 40 ppt and 44 ppt, respectively. These salinity limits were established based on a site specific Salinity Tolerance Study (see Attachment 4) and Chronic and Acute Toxicity testing (see Attachment 5). These limits are applicable to the point of discharge and reflective/protective of the Acute Toxicity effect of this discharge. The Huntington Beach Project NPDES permit also contains a limit for Chronic Toxicity but does not contain numeric limitations for salinity. Instead, the potential Acute Toxicity effect of the discharge is limited by a ratio of the daily discharge flow from the desalination plant and the power plant intake cooling water flow, which provides dilution to the concentrate. This dilution ratio requirement in effect provides a limit for the salinity discharge form the desalination plant and is derived from site-specific analysis of the conditions of the discharge for this project.

4. Concentrate (brine) from seawater desalination plants has the same color, odor, oxygen content and transparency as the source seawater from which it was produced, and increase or decrease in salinity will not change its physical characteristics or aesthetic impact on the environment. Therefore, a salinity limit will be of no consequence regarding protection of the appearance and aesthetics of the coastal area around the discharge.

5. There is no relation between the level of salinity and biological or chemical oxygen demand of the desalination plant concentrate – over 95 % of the minerals that encompass concentrate salinity are sodium and chloride and they are not a prime food source or a macro or micro nutrients for aquatic organisms.

6. Except for salinity, concentrate water quality from seawater desalination plants meets not only existing 2005 Ocean Plan numerical water quality objectives but also the primary drinking water quality standards of the Safe Drinking Water Act and the California Department of Health Services. Attachment 6 presents levels of metals in the source seawater and projected levels of metals in the concentrate from the Huntington Beach seawater desalination project. Review of this analysis shows that the discharge meets all the Ocean Plan limits and other than the elevated salinity, the concentrate would be safe to drink. From this point of view seawater concentrate is very different from the discharges from wastewater treatment plants or water reclamation plants.

7. Salinity contained in brine discharges from seawater desalination plants is not of anthropogenic origin as compared to the pollutants contained in discharges from industrial or municipal wastewater treatment plants or water reclamation plants. The minerals contained in the seawater desalination plant brine discharge have originated from the same source (the Pacific Ocean) to which they are returned. As a result, the environmental effect of seawater desalination on the ocean is equivalent to the effect of naturally occurring evaporation. Naturally occurring evaporation tends to concentrate salinity in shallow near-shore enbayments of the ocean during the high-temperature dry periods of the year and to dilute them during the rainy periods of the year keeping a net zero sum salinity effect. Similarly, seawater desalination plants temporarily remove a small portion of ocean water, produce fresh drinking water, which in turns is returned to the ocean via the ocean discharges of the wastewater treatment plants located in the vicinity of the desalination plant, thereby re-uniting the separated fresh water and salts, both of which originated from the ocean, within a period much shorter than the seasonal interval which returns the water removed form the ocean by evaporation.

COMMENTS ON NARRATIVE AND NUMERIC OBJECTIVES FOR SALINITY

Establishing an objective single "blanket" narrative water quality limit for the percentage of salinity above natural background presents the following challenges:

1. The salinity of the natural background is different at different locations, and therefore the salinity limit derived from such narrative objective will differ and sometimes may exceed or underestimate the salinity tolerance of the aquatic environment. This is especially true for transient marine species. For example, the enclosed studies indicate that the marine organisms living in the vicinity of the Carlsbad project can tolerate long-term exposure to salinities of 40 ppt and greater (See Attachments 1-5). If the background salinity near Carlsbad is used a basis for the permit, and a 10 % increment is applied as a criterion, the salinity limit imposed at the edge of the zone of initial dilution would be 36.8 ppt, as opposed to the 40 ppt limit set forth in the Carlsbad NPDES Permit. Both limits would be equally protective of the marine environment because what actually drives the effect on the environment is the tolerance of the marine organisms which inhabit

it, not the actual value of the background salinity. On the other hand, if a limit of 36.8 ppt is used rather than 40 ppt, this limit would be overly constricting for the project. This example shows that a "blanket" narrative limit may unduly hinder the implementation of desalination projects rather than protect marine environment.

2. The variation in background salinity will also differ from location to location. In open ocean environment salinity may naturally vary ± 10 % from the average annual value (i.e., a total salinity variation bracket of 20 %), in more shallow areas along the coast this variation may be higher. A good example is the source water quality variation documented during the desalination pilot testing completed by Marina Coast Water District in 2005/2006 (see Attachment 7). The average salinity concentration of the source water for this desalination plant was 21,700 mg/L, the maximum was 29,000 mg/L (+34 %) and the minimum was 2,500 mg/L (-768 %). If, for example, a typical open ocean salinity variation of 10 % is chosen as a "blanket" narrative objective for the entire State, than this objective would be overly restrictive and completely detached from reality for the Marina Coast desalination project, because the source water of the desalination plant will be more saline than the brine salinity limit and if the +34 % salinity variation is chosen, than the maximum state limit for the salinity discharge of the Carlsbad desalination plant would be 44.6 ppt, which is higher than the level established in the current Carlsbad NPDES permit. In both examples, however, the beneficial uses would be fully protected by the Ocean Plan toxicity objectives applied to site specific conditions in the vicinity of the discharge.

3. A narrative or numeric objective for salinity above ambient conditions may not provide adequate protection in cases of brine discharges that may cause significant environmental impact on marine environment due to ion-imbalance triggered toxicity. Toxicity of aquatic species can be caused not only by a higher salinity level but also by a significant difference in the concentrations of key ions contained in the brine and the same ions in the receiving ocean water (see Attachment 1). Ion-imbalance related toxicity is common for brackish water brines where the water source is very different in ion content or mixes of brines with fresh water discharges such as these from wastewater treatment plants. The potential for a given brine to exhibit ion-imbalance triggered toxicity depends also on the marine environment in which the discharge occurs. For example, this problem is less likely to occur in case of estuarine environments in which species are exposed to wide range of salinities and variation of the content of key ions (Ca, Mg, Na, Cl, SO_4) in the brine. Such toxicity effect however, if very likely to be strongly pronounced in aquatic environment inhabited by species such as the sea urchins, sand dollars, sea stars, sea cucumbers, which have evolved in an open ocean marine environment where the ratios of the TDS to the individual ions that make TDS do not vary greatly. Since the seawater reverse osmosis (SWRO) membranes reject all key seawater ions at approximately the same level, the ratios between the concentrations of the individual key ions that contribute to the seawater salinity (Ca, Mg, Na, Cl and SO_4,) and the TDS in the concentrate are

approximately the same as these ratios in the ambient seawater. Therefore, marine organisms are not exposed to conditions of ion-ratio imbalance, if this concentrate is directly discharged to the ocean. Brine from a brackish water desalination plant or water reclamation plant however, may have lower TDS than the ambient seawater but very different ratios of the key minerals in this water to the TDS. If the discharge area is inhabited by marine organisms that cannot survive major shift in ion ratios (such as sea urchins, abalone, etc.), this discharge could cause toxicity even if the concentrate salinity is well within the levels of ambient ocean water salinity, or even below this level. In this case, a salinity limit will not provide protection of marine environment. However, chronic and acute toxicity testing, which is already incorporated in the Ocean Plan will identify the toxicity effect of low salinity brine caused by ion imbalance.

4. Neither narrative nor numeric salinity increment objective will address the toxicity caused by brine discharges of salinity significantly lower than the lower end of the natural variation of ambient seawater salinity at a given discharge location. Many marine species are less tolerant to significant reduction in salinity below ambient than to a significant increment in salinity (see Attachment 1). This means that a brine discharge into the open ocean inhabited by species with little tolerance to sudden drop in salinity, may exhibit toxicity because its salinity is too low. For example a discharge from a brackish water desalination plant or a water reclamation plant may have salinity of only 1000 to 5000 mg/L, while the minimum salinity in the open ocean may be – 10 % of average (i.e., 30.1 ppt). However, the toxicity testing water quality objectives already incorporated in the Ocean Plan will identify such problem.

5. A number of recent studies indicate that many marine species inhabiting the California Pacific Ocean coast, including the sea urchins, described in the 1992 SCCWRP study and referenced in the staff analysis, have much higher salinity tolerance levels than the cursory SCCWRP study suggests. The salinity tolerance levels are site specific and depend on the species, the exposure time and the environment.

    - The salinity tolerance study implemented a part of the environmental impact review of the 50 MGD Carlsbad seawater desalination project (see Attachment 5) completed on over two dozen marine species frequently encountered along the California coast, including sea urchins, indicates that these marine species can safely tolerate salinity of 40 ppt (19.4 % above ambient salinity).

Subsequent acute toxicity bioassay using Topsmelt test organisms completed in conformance with the NPDES permit requirements for the Carlsbad desalination project identified the following: (1) The No Observed Effect Concentration (NOEC) of the test occurred at 42 ppt of concentrate salinity; (2) The Lowest Observed Effect Concentration (LOEC) was found to be 44 ppt; (3) The plant is well below the applicable toxicity limit for salinity of 46 ppt or lower; (4) The No Observed Effect

Time (NOET) for 60 ppt concentration was 2 hours, while the Lowest Observed Effect Time (LOET) for the 60 ppt concentration was 4 hours. This means that for a short period of time the species may be exposed to salinity as high as 60 ppt without any observed effect. The results of the Salinity and Acute Toxicity Study are summarized in the table below.

Salinity and Acute Toxicity of Desalination Plant Concentrate

Concentrate Salinity (ppt)	Test Species Survival (percent of total)	Acute Toxicity of Concentrate TUa[1,2]
33.5 (Control)	100	0.00
36	95	0.41
38	90	0.59
40	**95**	**0.41**
42	97.5	0.23
44	85	0.69
46	**87.5**	**0.65**
48	80	0.77
50	55	0.97
52	62.5	0.93
54	45	1.02
56	55	0.97
58	65	0.91
60	37.5	1.06

Notes: (1) TUa calculated as: log (100 percent survival)/1. (2) Desalination NPDES Permit TUa Performance Goal = 0.765

- A site investigation of a number of existing full-scale seawater desalination plants operating in the Caribbean completed by scientists from the University of South Florida and the South Florida Water Management District in 1998 (See Attachment 8) has concluded that the salinity levels of 45 ppt to 57 ppt have not caused statistically significant changes in the aquatic environment in the area of the discharge.

SUMMARY AND CONCLUSIONS

The existing 2005 Ocean Plan already contains state-wide numeric objectives for controlling and monitoring of the effect of salinity of seawater desalination plant discharges on the aquatic environment – the Acute and Chronic Toxicity Objectives defined in Table B of the Ocean Plan.

Since salinity has no other effects on the marine environment except to potentially exhibit toxicity under site-specific conditions, any potential narrative or numeric water quality objectives would need to be derived from the toxicity objectives, and therefore will be duplicative. As a result a "blanket" state-wide salinity limit will create an unnecessary regulatory compliance burden and expenditures without providing additional protection to the aquatic environment. It may also unnecessarily discourage the development of seawater desalination projects at a time when the State's traditional water resources are stretched beyond the practical limit.

The potential and level of salinity to exhibit toxicity is site specific and is driven by a number of factors which may vary in a wide range from one discharge location to another and from one type of brine discharge to another. Therefore, a determination of a need for a site-specific salinity limit for a given discharge and the type of this limit (numeric or a water quality objective) should remain at the discretion of the regional water quality control boards as it is at present. Given the already tenuous water supply situation in California, this would be a prudent course of action.