

Review of 3 West Basin Municipal Water District Documents:

1. HIGH SALINITY SENSITIVITY STUDY:  
VOLUME 2: LONG-TERM EXPOSURE ASSESSMENT

*Preliminary Draft*

Prepared For:

West Basin Municipal District  
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Prepared By:

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August 2012 12 pg.

2. Hyper-Salinity Toxicity Thresholds for Nine California Ocean Plan Toxicity Test  
Protocols

Final Report

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Prepared for:

California State Water Resources Control Board  
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3. High-Salinity Sensitivity Study  
Short-and Long-Term Exposure Assessments

Prepared For:

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## 1. Preliminary Weston Solutions: August 2012

### **General Comments:**

This study was apparently a preliminary report and subsequently included in a 3<sup>rd</sup> document as a “Mesocosm study” provided below. This “mesocosm” study attempted to evaluate the impacts of a 14 day exposure to various salinities on multiple marine intertidal and subtidal invertebrate/fish species. The studies were conducted in single chamber tanks throughout an 8 month period using up to 3 trial periods. Not all organisms had 3 trial periods and the same 2 tanks were used throughout the experiment and occurred at concurrent seasonal dates throughout the year. The conclusions of the study were that exposures to >41 ppt caused adverse impacts particularly to invertebrate fertilization and development. However, salinity regimes between 41 and 33 were not evaluated.

While the study used California native species for experiments, the experimental design was flawed and did not include appropriate controls (positive), QA, or replication. For the urchin/mussel development studies 5 replications were taken, but were from the same single tank again confounding statistical evaluations of the salinity treatment. In addition, statistical method descriptions were not included in this not the subsequent September report (see below).

### **Specific Comments:**

How were dilutions and water quality monitored; particularly temperature if conducted throughout the year?

This study truly suffers from temporal differences in observations. Temporal replication is not a valid approach if ambient conditions were used as control. Organisms are at extremely different stages of development over 8 months.

The rationale for 14d exposures was unclear. It was unclear how “long term” was defined.

Other design questions: How long were the animals housed before placed in tanks and exposures began? Where were feral animals collected? Were they depurated?

What was the source of “control” water? Was it taken from the Power Plant influent at Kings Harbor?

Having one tank for control and one tank for treatment still leads to an N of 1 observation (even though multiple animals are evaluated in that tank---pseudo-replication). Need one holding tank for each replicate.

How was behavior quantified? Were standard assays used?

Sea Urchin and Mussel Development Tests; While these are sensitive measures, these tests are not true chronic effects. These are USEPA “short-term tests that *estimate* chronic effects”.

In contrast to the text of the Aug report, reproduction was not evaluated (typical reproduction endpoints include fecundity and hatchability). Only fertilization and embryonic development was measured. What was the rationale for exposing hypersaline gametes to regular saline water?

Table 1 What was rationale for the salinities selected?

Table 3 Lack of replication

Table 7 Different fish in each trial (size classes varied in “controls”)

Table 8 and following Not sure why title is “long term”, unless it is describing adult exposure?

Were comparisons statistically evaluated? What tests were used?

Where was mid or low salinity exposures for mussel embryo development?

Table 10 control values too high ...not valid...

**Recommendations:**

1. Given the flawed experimental design, conclusions from the study cannot be validated. Use EPA mesocosm methods.
2. Use realistic salinity increases of 2-3 psu rather than 7-8 psu.
3. Carry out appropriate replication for statistical evaluations
4. Evaluate reproductive, endocrine and behavioral endpoints with species that have life histories that make them susceptible to salinity change
  - a. Benthic Invertebrates/Algae
  - b. Euryhaline Fish (salmonids, demersal flatfish)

## 2. Phillips et al. Report

### **General Comments:**

This study carried out well documented concentration response experiments with two different concentrates (one from Saltwater and one from RO). The QA was excellent and the studies were well performed. Appropriate statistical design was utilized and multiple species were examined. Overall conclusions were that impairment of invertebrate larval development was observed at 3-4 psu above ambient.

### **No specific Comments:**

### **Recommendation:**

1. As stated in the report, true “chronic” endpoints need to be evaluated to confirm effects from short-term exposures to hypersaline conditions. I would recommend reproduction, endocrine, and behavioral endpoints particularly in susceptible species that reside in estuarine systems.
2. Results were consistent with Brine Panel report threshold of +5 psu.

### 3. Weston Solutions October 2012

#### **General Comments:**

This study was apparently a compilation of a previously described “mesocosm” study (see above) and one where standard WET testing was conducted using a range of standard marine models which occur in estuarine and marine ecosystems of the Pacific ocean.

The WET testing was well conducted with appropriate controls and quality assurance/control. A classic “Range-Finding” experimental design was used and indicated sensitive species for a “definitive” Phase II assessment. Endpoints included sublethal (growth) and survival (acute) measures. Replication and statistical evaluation was appropriate and the conclusions were sound. Survival and growth were the only chronic endpoints measured. Reproduction was not evaluated.

For my responses of the Mesocosm study, see the initial section. There was not any additional information that altered my original assessment.

#### **Specific Comments (in addition to original comments of Aug 2012 report):**

Page 1 and Page 4 indicated 7 day mysid fecundity was evaluated, but subsequent text and lack of data indicates fecundity was not evaluated.

Page 71 2<sup>nd</sup> para line 11....”slowly” raised back to ambient before raising them again, does this mean only 3 aquaria were used and then re-used? Independent aquaria should have been used for each manipulation

Page 80 2<sup>nd</sup> para Bottom line....Appendix B was not provided

Page 82 2<sup>nd</sup> para Line 6 states there was not a statistically significant change in development, but yet there are no statistical methods presented (as above).

#### **Additional Recommendation (see above for original comments of 2012 report):**

1. If the investigators wish to conduct “mesocosm” studies, then a consistent use of ASTM or EPA Mesocosm protocols should be utilized.
2. A WET endpoint of fecundity or hatchability should be included for the chronic exposure durations in Mysids.
3. WET studies well conducted and consistent with threshold of +5 psu as recommended by the Brine Panel